

volume 1: main report



# A Management Plan for Back Bay

Virginia Beach, Virginia

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with water quality consultations by Jason M. Cortell and Associates, Inc.



## City of Virginia Beach

December 7, 1984

To the Honorable Mayor and  
Members of City Council

Dear Council Members:

On February 1, 1982, the Mayor's Back Bay Study Committee was appointed and charged with the task of investigating the current status of the marine ecosystem of Back Bay and land usage in its surrounding watershed in order to develop policy recommendations aimed at guiding future decisionmaking. From the very beginning, it became quite clear to each committee member that the story of Back Bay would be a very complex one. Back Bay is a place where the diversity of ecology and natural environment meets the rich history, traditions, and pursuits of a distinctive rural community. This "watershed" comprises nearly one quarter of the city of Virginia Beach and is beginning to feel the pressures of change. As changes take place, their benefits must be weighed and their impacts minimized if we are to protect the valuable resource that is Back Bay for future generations of residents and visitors.

Until now, there has never been a comprehensive study performed on Back Bay which would provide detailed information on the complex cause and effect relationships of man's actions in the watershed, plot the course of recent ecological trends in the Bay, and develop a sophisticated plan of action for use at the local level. A Management Plan for the Back Bay Watershed is meant to fulfill that need while serving in conjunction with the Comprehensive Plan to provide a basis for decisionmaking by private interests and public bodies alike within a coordinated and comprehensive framework. Our citizens will find the material contained herein presented in an engaging, readable, and informative manner supported by a wealth of up-to-date technical data. So structured, the management plan will meet a broad range of demands for information and direction.

It is the committee's hope that over a period of several years, as this plan is implemented, Back Bay will show definite signs of improvement in the areas of water quality and species diversity without the undue and irreversible detriment brought about through change that is unplanned, or actions that are inadvertent. The task of preserving one of the city and state's most valuable natural assets has not been completed but, now with this first Plan, it has begun.

With pride in and high hopes for Back Bay, this Management Plan is submitted for your approval.

Sincerely,

The Mayor's Back Bay Study Committee:

*Barbara M. Henley*

Barbara M. Henley  
Councilwoman, Pungo Borough

*John A. Baum*

John A. Baum  
Councilman, Blackwater Borough

*C. Oral Lambert*

C. Oral Lambert, Director  
Department of Public Works



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## PREFACE

Virginia Beach's Back Bay is a remote, untamed estuary lying in the lee of False Cape, a landscape and seascape of marshes and open water, dune ridges and islands, watermen and anglers going for large-mouth bass, ducks and geese carving flight formations against the open sky. It is also a thousand other things to thousands of other people: it is a place for respite and reflection, it is a place for indulgence in the excitement of coastal wilderness. It is a land to farm. It is home, too, for small villages and hamlets dating from the colonial age of Princess Anne.

Above all else, the marvel of Back Bay is that it is what it is within the embrace of a rapidly urbanizing region. It exists wholly within the municipal boundaries of Virginia Beach, among the fastest growing cities in the United States. Its existence as a district of the City raises a challenging issue: will the wildness and beauty of Back Bay continue to survive, a protected precinct within a populous city? Or will it, and the rural lands of its watershed, succumb to inevitable expansion of development southwards from central Virginia Beach?

The questions are tough and challenging, the potential answers even more so.

This report was undertaken by the City of Virginia Beach to identify the measures that could be adopted by the City, as well as other public bodies and the private sector, in pursuit of the City's Comprehensive Plan. The Plan, approved by City Council, states as policy that the rural qualities of the Back Bay area are of value to Virginia Beach and that residential development of densities greater than those which presently exist would erode these qualities.

The recommendations offered by this report are in direct response to the City's study mandate. Some will undoubtedly generate wide public discussion, but this is inevitable, appropriate, and timely, for the future of Back Bay is worthy of the close attention at this time of the people and institutions of Virginia Beach. Hopefully, the end results of this discussion will provide Virginia Beach with the means to better manage and enjoy the qualities of Back Bay and its adjacent lands for many generations to come.







# **SUMMARY OF SELECTED MAJOR RECOMMENDATIONS**

## **Principal Findings**

**1** Back Bay and the watershed and other related lands associated with its resource quality are of unique environmental, ecological, cultural and economic value, in its present condition, to the City and people of Virginia Beach.

**2** Maintaining the diversity and abundance of Back Bay wildlife, fisheries, floodplain, agricultural uses and productivity, and rural characteristics of the Back Bay watershed and those portions of the North Landing River watershed and the Atlantic Shore in which human actions might affect this diversity and abundance is a proper goal for the City in pursuit of protecting the Back Bay's resource values.

**3** Alternate strategies for improving the City's means for achieving this goal might be considered. Full public discussion and full appreciation of the implications of each strategy should be undertaken and a clear and consistent set of steps subsequently adopted.

## **Urban Development**

**1** A Land Management Enhancement Strategy would constitute the least degree of change in City tools. It would include:

- Extension of the "Green Line" northward at selected points to protect prime agricultural soils and critical watershed drainage areas and upland wildlife habitat.
- Retention of existing zoning.
- Amendment of zoning to eliminate "spot" zoning.
- Maintaining the current capital improvements program for the Back Bay and North Landing River watersheds.



**2** An Improved Land Management Tools Strategy would imply a moderate degree of change. It would include:

- Amendment of the Comprehensive Plan to create a new "Back Bay Management District" to articulate goals, objectives, and policies for development and resource conservation. The district would extend to all Back Bay watershed lands and waters, those of the North Landing River watershed flanking the Pungo peninsula, and the Atlantic shore.
- Amendment of the Comprehensive Zoning Ordinance to create new zones to protect forests, primitive lands, and productive agricultural soils within the Back Bay Management District.
- Reduction of front foot property tax assessments for productive agricultural lands.
- Establishment of a "Public Lands Trust" to which open space lands can be donated, free of inheritance tax.
- Adoption of other measures that can be easily adopted without significant changes in City authority or programs, including those which are also included in the Land Management Enhancement Strategy defined above.

**3** A Protective Watershed Management Strategy would entail the greatest degree of change in City tools, but would achieve the greatest improvement of Back Bay resource protection. It would include:

- Creation of a Back Bay Management District, as also recommended under the Improved Land Management Tools Strategy.
- Adoption of zoning for areas of critical community value. This measure would be similar to the recommendation for new zones under 2b, above. Areas of Critical Community Value could include, in addition to forests, primitive lands, and productive agricultural soils: hamlet centers, public access points, floodplain areas adjoining critical wetlands and wildlife habitats, and lands adjoining significant aesthet-

ic and environmental resources, such as the Lotus Garden.

- Creation of a Virginia Beach Land Bank. This measure could require substantial start-up financing, but through its revolving fund, could allow the City to acquire land threatened by inappropriate development and to later resell such land to appropriate users under suitable deed restrictions.
- Adoption of a system for the Transfer of Development Rights (TDR). This measure could require moderately substantial administrative effort, but would allow private land owners and developers to work out the transfer of development under City guidance. TDR would not prevent all development, but much development could be diverted to more suitable areas outside the Back Bay and North Landing River watersheds, to the satisfaction of both land owners and developers.

### **Water Quality and Salinity Control**

**1** The Little Island Salt Water Pumping Station should be maintained at its present capacity, but its pump lines should be extended 6000 feet, with three spaced outfalls to permit better dispersion of introduced salt water. The improved dispersion should achieve somewhat higher average salinities in those portions of greater Back Bay where salinity is presently low and should prevent the excessively high salinity peaking that occurs with the present inadequate dispersion.

**2** Agricultural practices should be improved in several respects:

- Cropland erosion should be minimized through proper crop rotation and other measures.
- Modified-till and no-till practices should be adopted, where soil qualities allow.
- Livestock animal waste holding facilities and lagoon spoil mounds should be properly designed and maintained.

The reader will find these and other recommendations more fully explained

on the following pages. The decisions the people of Virginia Beach and their governmental institutions will be making in near time on management approaches and techniques for the Back Bay will help determine the future of this unique resource for all time.

Therefore, good reader, consider well the contents of this report and guide your conclusions of the future of Back Bay accordingly.





## Chapter 1

# AN INTRODUCTION

### Back Bay

Virginia Beach's Back Bay is a rambling estuary located in the city's southern sector, separated by False Cape from the Atlantic. It is bordered by the Dam Neck-Sandbridge area on the north, the Pungo peninsula on the west, and the Virginia-North Carolina state line on the south. Beyond the state line, Back Bay merges with Currituck Sound, which in turn joins Albemarle and Roanoke Sounds; the four water bodies constitute the northern half of the great estuarine ecosystem that lies in the shelter of the Outer Banks-Hatteras barrier island chain.

Within greater Back Bay lie five sub-bays: North Bay, at the northern tip between Sandbridge and Pungo, Shipp's Bay, Redhead Bay, Sand Bay, and Back Bay proper. Numerous channels, narrows, and guts link the sub-bays together, as does cross-wetland drainage.

Hundreds of islands and peninsulas mark the Bay. Some are purely marsh, others are relic sand ridges poised a few feet above the water, others are combinations of sand and silt. Here and there, organic soils lie in shallow layers on or beneath the surface. On the sand ridges and other upland reaches of the islands and shores, trees rise to create a forested silhouette on the Bay's remote horizons.

The water surface of greater Back Bay measures about 39 square miles. The uplands and wetlands that surround the Bay cover an additional 65 square miles, accounting for a total of approximately 104 square miles of watershed land and water resources, or roughly 30 per cent of the total city area of Virginia Beach.

Those 65 square miles of land, which drain into Back Bay and therefore control to a large degree the quality of water in the Bay, are largely rural and sparsely settled. Agriculture, including hog raising, grain and soybean cropping,

some horse-breeding, and a few other farming pursuits, is the major land use of the watershed. Worked agricultural lands totaled about 21 square miles in 1983.

Much of the remaining uplands are either wooded, where soils are insufficiently productive for today's farming, or occupied by farm houses, non-farm residences, farm-related storage and service facilities, and minor commercial land uses.

A major portion of the perimeter and some of the interior shore marshes and islands of this marvelous coastal resource live under the protection of federal, state, and local government. The False Cape barrier beach is a state park from the North Carolina border up to the southern boundary of the Back Bay National Wildlife Refuge. Little Island Park is a former Coast Guard Station area owned and maintained by the City of Virginia Beach at the south end of Sandbridge, the beach community that occupies the rest of the hinge between False Cape and the mainland.

The Back Bay National Wildlife Refuge lies astride the center of greater Back Bay, reaching from the Atlantic shore of False Cape through the large central islands of the Bay to the marsh and swamp edge of the mainland between Redhead and Shipp's Bays. Established in 1938, the Back Bay National Wildlife Refuge covers 4600 acres of upland and wetland and another 4600 acres of open water. The Mackay Island National Wildlife Refuge is located principally on Knotts Island, astride the state line. The Virginia Pocahontas and Trojan Waterfowl Management Areas are located at the Bay's southwestern corner, adjacent to the Mackay Island National Wildlife Refuge.

Princess Anne Road, the principal and historic north-south coastal route of tidewater Virginia, runs through the watershed from its northern center along the Pungo peninsula to Knotts Island, where it turns eastward onto the island



**False Cape sector of the Back Bay National Wildlife Refuge**



**Cropped lowlands of the Pungo peninsula**



**Sandbridge, viewing south over False Cape and Back Bay**

before continuing south to and beyond the state line. Branching out from Princess Anne Road, a network of paved and unpaved roads and lanes carry traffic to and from the farms, hamlets, woodlands, and shore access points of the watershed, as they have for many years, in some cases since the early 17th century beginnings of settlement. Princess Anne Road itself follows the backbone of the Pungo peninsula, avoiding the often flooded lowlands.

Beyond Princess Anne Road to the west, land falls generally within the North Landing River watershed, draining through a marshy perimeter into the waterway for which it is named. Although this narrow west flank of the Pungo peninsula does not drain into Back Bay, its dependence on Princess Anne Road for vehicular access binds its land uses and the road traffic it generates closely to land use and road usage within the Back Bay watershed. Ultimately, what happens on one side of the peninsula affects the other side; any concern over the protection of environmental quality in Back Bay must necessarily be extended to the North Landing River side of the Pungo peninsula.

Similarly, what happens on the Atlantic drainage side of False Cape, in terms of present and future recreational use and any new road access, may affect environmental quality within the Back Bay watershed, although it is far more likely that stringent state and Federal controls will continue to maintain present environmental quality on this coastal edge.

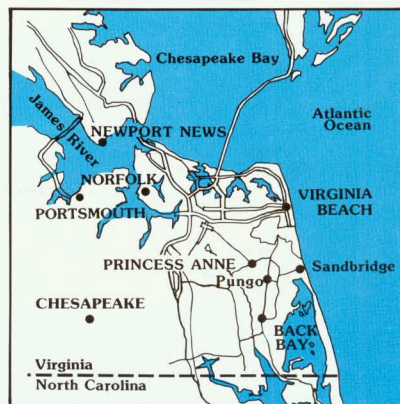
## The City

The City of Virginia Beach is one of the fastest growing coastal cities of the United States and is one of the largest eastern coastal cities in municipal area. With a 1984 estimated population of 305,000, its current annual residential growth rate is approximately 5 per cent. Flanked by the Atlantic Ocean, long beaches and scenic inlets and bays, the city has long attracted residents and businesses. Its proximity to the naval and maritime facilities of Portsmouth, Norfolk, and Newport News and its employment as a location for the Oceana Naval Air Station, Camp Pendleton State Military Reservation, Little Creek Naval Amphibious Base, Fort Story Army Post, and other military installations has also made it an attractive residential location for military and civilian personnel and their families, as well as a suitable location for defense and maritime related industry.

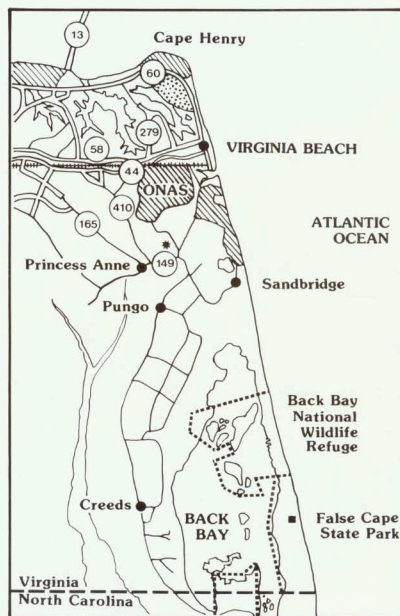
Virginia Beach, however, is much more than a Navy-related city. Because of its attractive beaches, water edges, climate, and ease of access to numerous recreation activities, Virginia Beach has become a magnet for summer vacation and resort functions, conventions, conferences, and festivals. It is home for a growing, year-round residential population, businesses, advanced technologies, and corporate headquarters.

For this growing city, the lands of Back Bay appear desirable and developable, a paradox that may one day cease to exist, since once urbanized, the watershed may no longer have the same appeal it carries today.

The City's Comprehensive Plan established a "green line" along Sandbridge Road. Intensive development would be permitted to extend southward from central Virginia Beach up to but not below the Road. Below it, the Back Bay and North Landing River watersheds were deemed to possess prime agricultural and rural character, the value of which would erode if this region were to be urbanized.



Back Bay within the Virginia Tidewater today



The City and Its Back Bay



## Chapter 2

# THE RESOURCES OF BACK BAY: A REALM OF IRREPLACEABLE SPLENDOR

There was a time, not long ago, when urban America shunned the shores and waters of the nation's untamed coastal estuaries—the lagoons and wetlands that lie behind the barrier islands and headlands of the ocean rim. Too many fine alternatives existed to please the eye and warm the heart of the recreationist. Ocean beaches, national and state parks of mountain and lake country, and numerous other destinations drew hikers and campers, the weekend-ing family, sightseers, day visitors. There were also those who had a positively dim view of these quiet estuarine resources. Many developers and a good part of the general public saw the fallow reaches of saltmarsh and tidal flats as “waste lands”, “unproductive” areas that yielded no or little tax revenue to the communities in which they lay and which could better serve the common good if they were filled or developed for “economic use.”

Many others disagreed. There were those who knew the bays and their marshes from the roots up. Knew how they served as home for a myriad of creatures and shelter for numerous others. How striped bass nursed there before getting out to sea, where great blue herons sliced low above the water, rising slowly and magnificently beyond the trees. Some even understood that these, too, had economic value, either for their role in the great food web that supports the ocean fisheries, or for the aesthetic value so important to vacation and recreation spending.

Not too long ago, in the 1950's, Rachel Carson's book, *Silent Spring*, opened the eyes of many Americans to the fragility of the natural environment under the impact of human actions. Aldo Leopold's earlier book, *Sand County Almanac*, was rediscovered and shed more new light on the intricacies and sensitivities of the relationships among the living beings of the natural environment, be-

tween them and their habitat, and among the inanimate pieces of their habitat. The word “ecology”, coming from the Greek for “study of home” and representing the totality of any set of environmental relationships, became a part of everyone's lexicon.

Soon, in the late 'sixties and in the 'seventies, more and more came to be known about the forgotten resources that dwelled in the lee of our coastlands. Flood



Osprey returning to nest

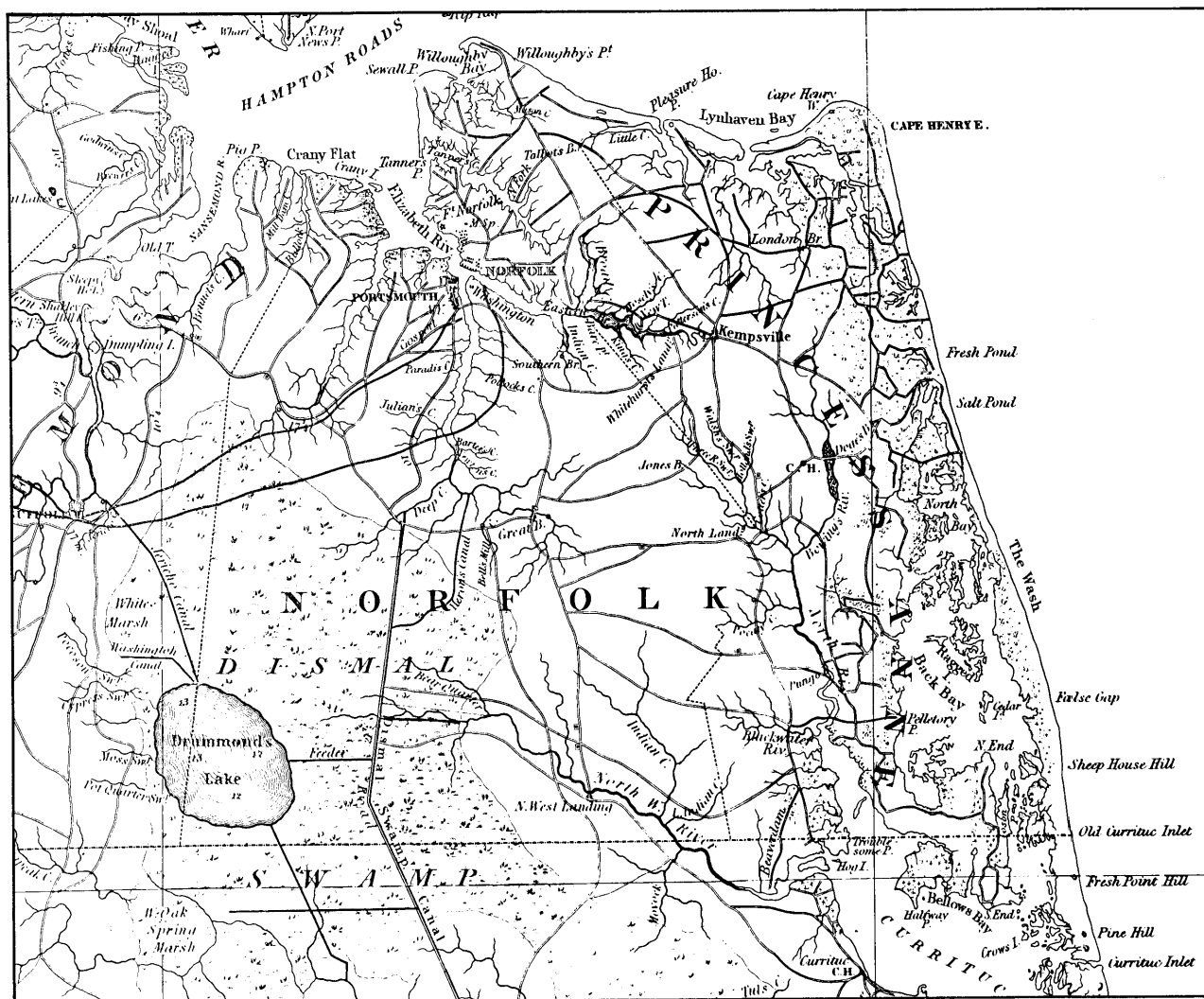
plain and wetland protective legislation at both the state and federal levels offered new means for maintaining the magnitude and the health of these resources.

In the Back Bay region, federal and state attention and protection were initiated many years ago. The Back Bay and Mackay Island National Wildlife Refuges, the Virginia Trojan and Pocahontas Waterfowl Management Areas, and False Cape State Park are proof of these concerns. The State Water Control Board and Commission of Game and Inland Fisheries exercise monitoring and enforcement responsibilities that help sustain and reinforce environmental quality in the Bay. Virginia Beach manages the very small Little Island Park south of Sandbridge, but its activity in protection of Back Bay's resources ranges much further, throughout the district. The City's Wetlands Board reviews, and approves or rejects, any proposal for filling or dredging. The City, through maintaining the protective provisions of its Comprehensive Plan and Zoning Ordinance, also acts to maintain the rural character of the area of the watershed, especially below the Green Line.

All in all, there are many more people today than there were a generation ago who are concerned over Back Bay's resources. Gone are the early days when only watermen, the people of the Pungo peninsula, dedicated outdoorsmen, naturalists, and chance discoverers knew of Back Bay, its beauty, and its importance.

Today a wiser world knows how crucial Back Bay is. Not only how crucial to the bass, the mallards, the herons, the deer, the loons, the ospreys, the peregrines, and hundreds of other species of animal life, but to the people of Virginia Beach and the Tidewater, for the resources of Back Bay constitute a realm of irreplaceable splendor, one which sustains the quality of life for all who know or





**Back Bay and its region  
in mid-nineteenth century**

visit it, and without which life in the region would be the poorer.

### **Physiography: The Form of the Bay, its Lands, and its Streams**

The flatness of the lands surrounding Back Bay is the central topographic characteristic of the watershed. Pungo

Ridge, the backbone of the Pungo peninsula, carries the highest land elevations on the west of the Bay, reaching 15 to 20 feet above mean sea level (MSL) at several points in the vicinity of Pungo and Back Bay villages. On the east flank of the Bay, the sand dunes of False Cape present a second line of higher elevation, reaching 50 feet MSL or more at a number of locations and 64 feet at the highest.

In between these parallel ridges on the Pungo side lie the better drained uplands, falling away from the highest elevations to an imaginary line that is generally about 5 feet MSL. This lower elevation is the upper edge of the flood plain. Here is where one finds the principal marshes and swamps of the Bay's edges, but throughout the flood plain, at its higher elevations and where the soils are inclined to dry out more readily, crops are farmed. Because of the universal flatness and low elevation of the land, flood frequently bedevils the farmers who seek to crop here, particularly below the 3 or 4 foot contour levels.

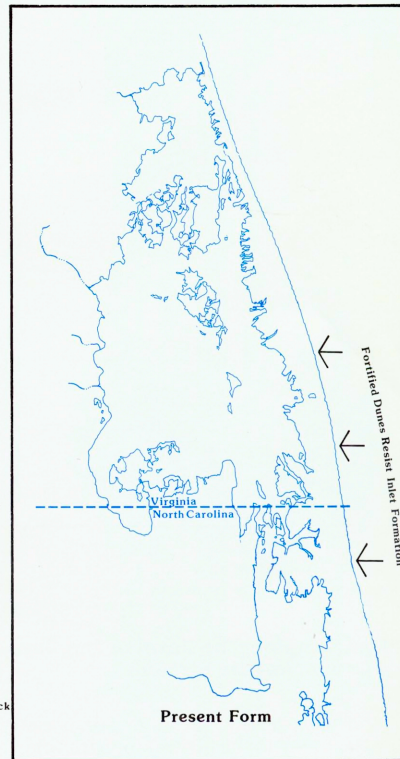
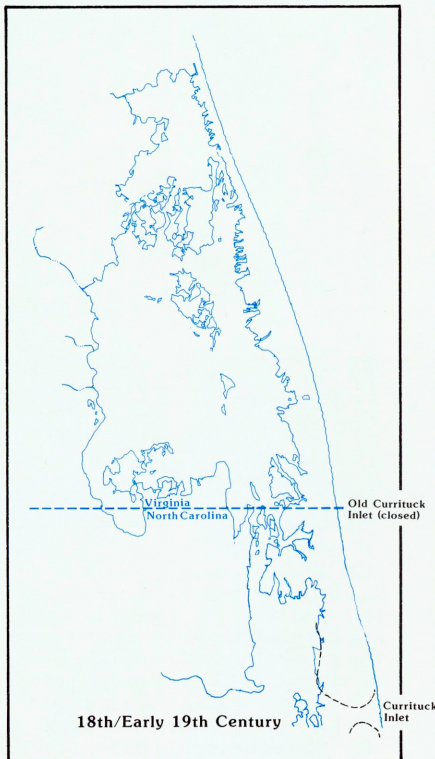
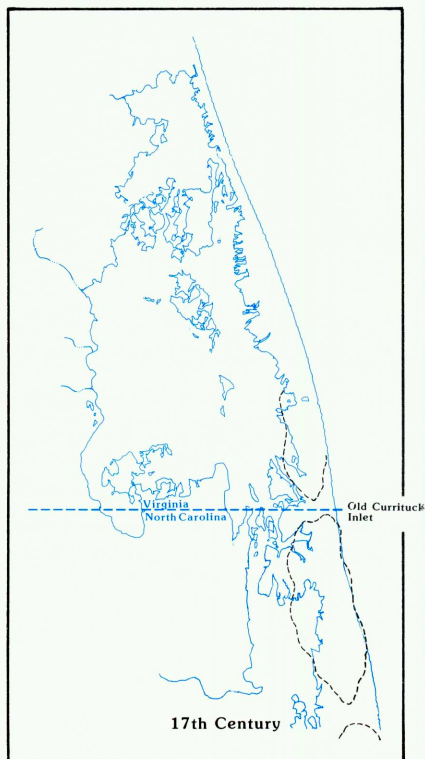
Cutting down through the western land mass are a number of creeks. Hell

Point Creek and Muddy Creek, debouching at the northwest corner of North Bay, are partly combined by a man-made channel. Beggars Bridge Creek flows into Shipp's Bay. Nawney Creek flows into the Bay at a point between Redhead Bay and Back Bay proper. Devil Creek, the smallest of the four, finds the end of its brief passage to the Bay near the center of Back Bay proper. Because of the small dimensions of the watershed, each of these streams and other small creeks delivers only minor contributions of water flow to the Bay, except during periods of heavy precipitation. Each, therefore, is sensitive to even small introductions of pollutants, something that is often observed in the Hell Point Creek/Muddy Creek streams in the north, where urban and

agricultural run-off influences have been detected.

This shallow and subtly folded land mass, the edge of the Atlantic Coastal Plain that reaches from the Piedmont "Fall Line" at Richmond and other inland points down to the sea, possesses a rich diversity of land and water features that have emerged and adapted to Back Bay's template over eons of time. A frontier with the sea, it exhibits as much influence by the sea, and more, than it does of the land.

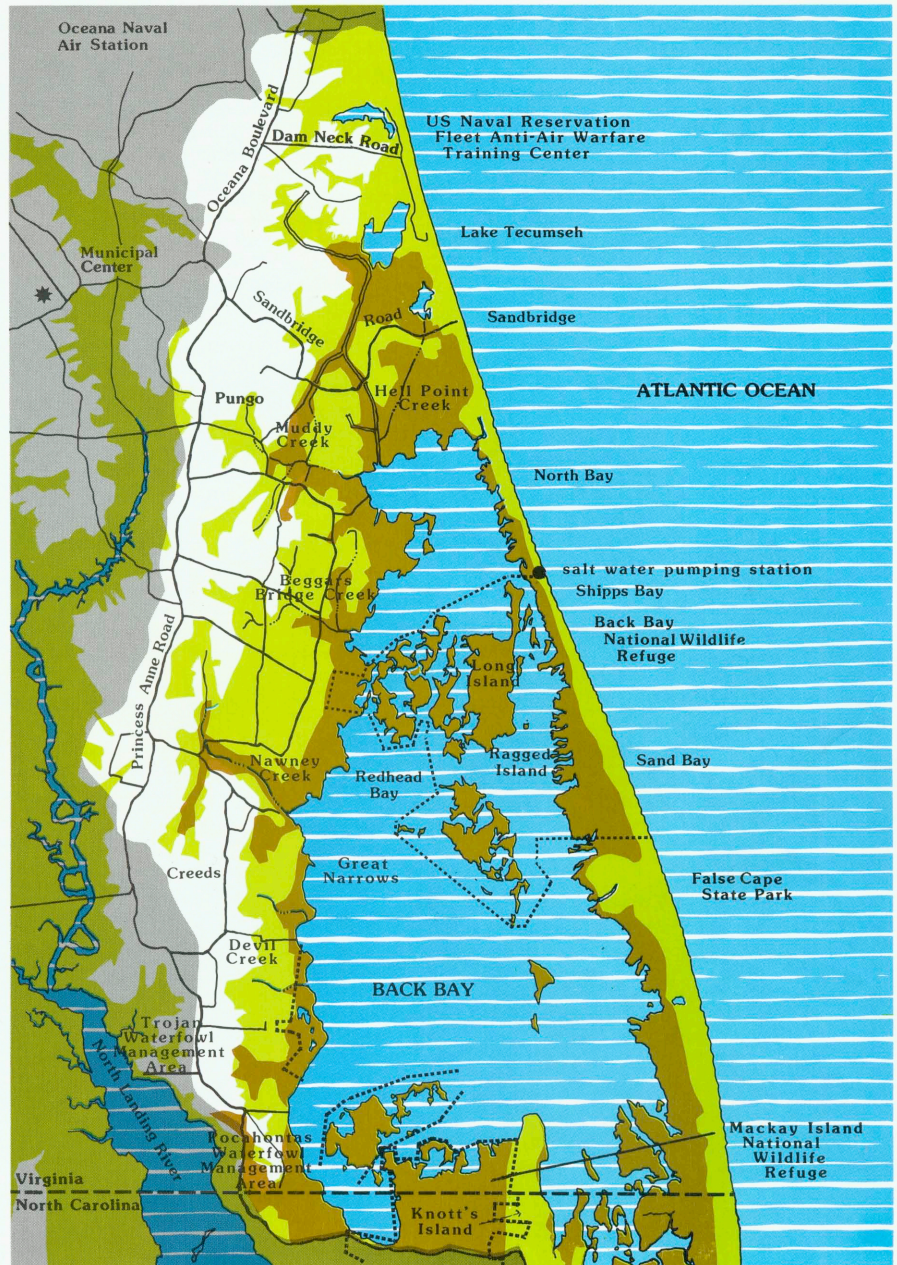
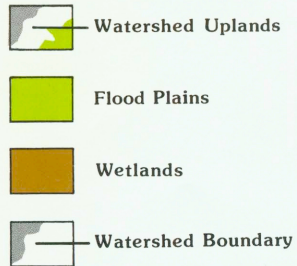
The single feature of greatest importance is the False Cape barrier island or barrier beach. This northernmost segment of the Outer Banks sand barrier



**The Shape of Back Bay:  
Historic Changes**



Map 1  
Major Features





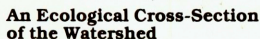
Wind is the force that raises the dunes, with the help of dune grasses and other plants that help hold the sand grains in place. It is also the force that helps destroy the dunes, blasting them in storm. Blown by on-shore storm winds, sand and soil are carried from the dunes to the Bay edge of the barrier. Here they fall, building up the lagoon bottom to a profile on which emergent grasses and sedges can easily grow. The process is magnified when storm driven waves

This violent pattern has occurred many times in the millenia since the barriers were first formed, creating islands and deltaic formations in their lee. The interior islands of Back Bay are largely a product of such storm overwash, but many of them are also the offspring of other origins as well: soil washed down by flood from the land on the west, silt carried by estuarine currents.

Another vital key to the secrets of Back Bay is the history of Currituck Inlet. In existence at the time of the first explorations of the coast in the early 17th century, this break in the barrier island chain served as the point from which a line was drawn due west to create the boundary line between the colonies of Virginia and North Carolina. More loyal to Mother Nature than the English throne, however, the inlet migrated southwards during the succeeding two centuries, responding to longshore currents and storm influences. Finally, in about 1850, the inlet filled in; similar processes were at work, but acted this time to deposit sand in the inlet, rather than scour it away.


At once, profound changes occurred in Back Bay's character, changes which have persisted to this day.

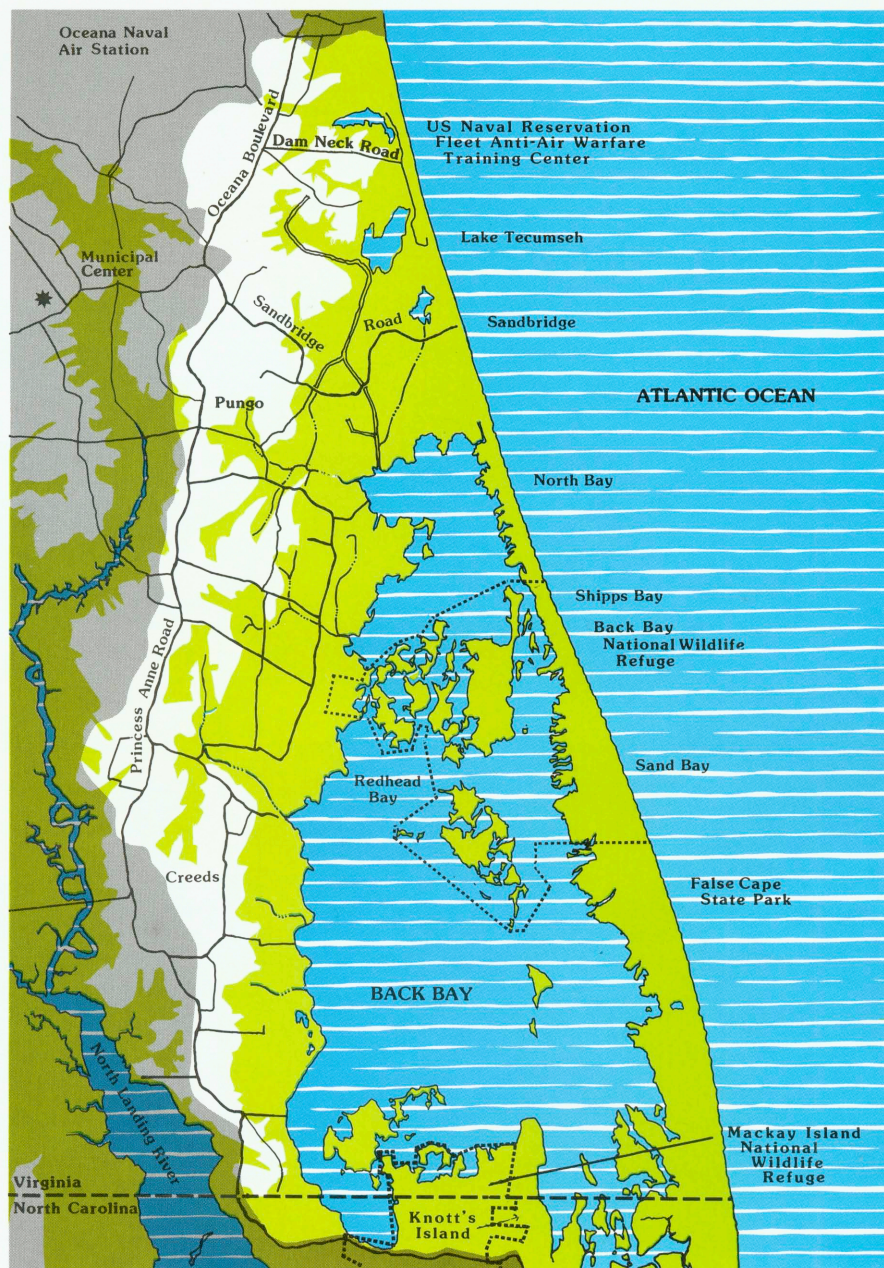
While the inlet was open, lunar tides ebbed and flowed into and out of Back Bay. Twice a day, the salt water of the ocean would invade the Bay mixing with the saline (moderately salty) waters of the Bay and the brackish (slightly salty) waters of the creek mouths. On balance, with dilutions of salinity by rainfall, directly on the Bay and through the creeks





Map 2  
Flood Plain

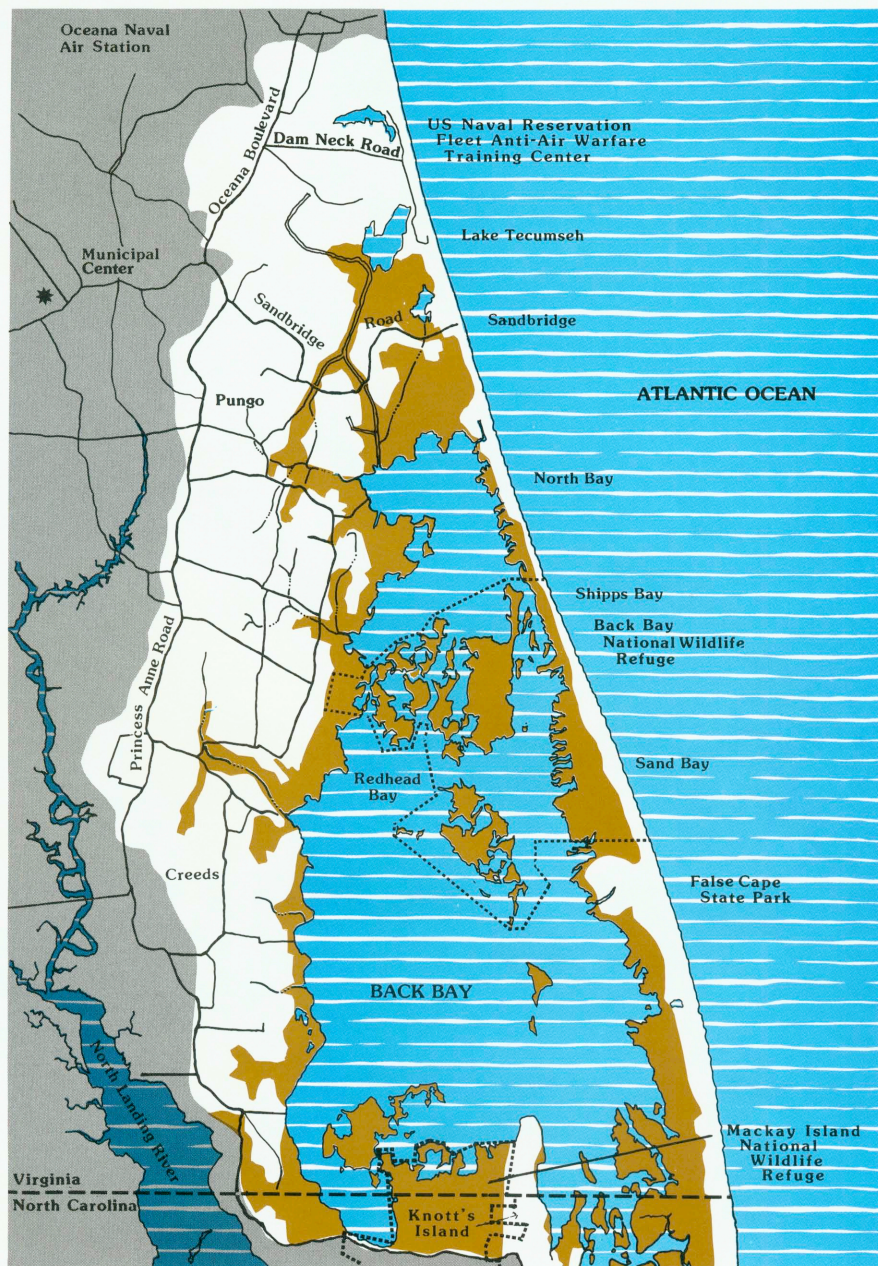
 Lands susceptible to flooding during storms of a magnitude likely to occur once every 100 years (100-year flood plain)





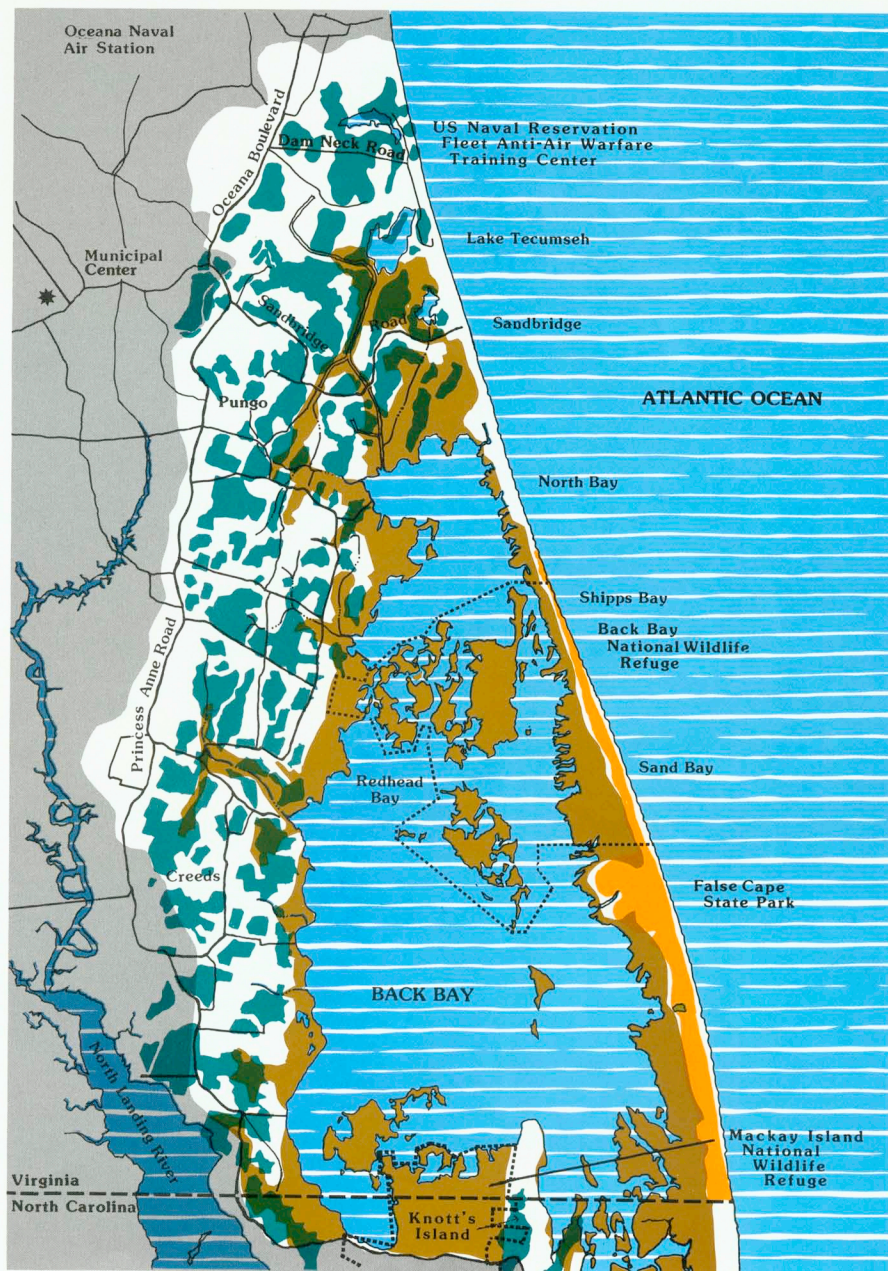
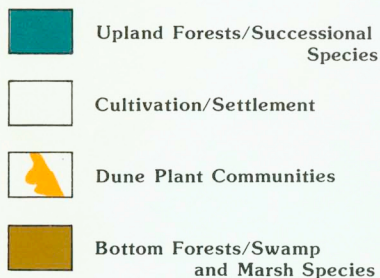
Map 3  
Wetlands

 Wetlands/primarily brackish marshes and swamps





Map 4  
**Terrestrial Vegetation**



off the land, a saline environment prevailed. This was sometimes saltier, sometimes less so, but consistently saline within a range that sustained many fish, mollusk, crustacean, and other species dependent on this unique environmental characteristic.

Once the inlet closed, however, the Bay's waters turned rapidly less and less saline. Without the regular mixing of ocean water, the influence of fresh water was predominant. Only occasional storm overwash brought in masses of salt water. The influence of lunar tides from Currituck Sound was vastly diminished. The great distance from the next closest inlet, Oregon Inlet, and the presence of numerous islands and narrows in the Sound, dampened most of the effect of lunar tides before they reached Knotts Island, at the southern edge of Back Bay. When the Princess Anne Road causeway to Knotts Island was built in 1890, lunar tidal influence from the south was reduced even further. Lunar tides today create a tidal amplitude of probably 0.5 foot at Knotts Island and only 0.25 foot in the northern portions of the Bay. Little or no salinity is added from Currituck Sound to the water of Back Bay through lunar tides.

### The Living Resources

Gone, therefore, are the shrimp, clams, and striped bass of a century ago. Now other aquatic life prevail. Large-mouth bass, bluegills, and black crappie are the most fished-for species in the Bay. These, and other common species such as yellow perch, channel catfish, chain pickerel, and pumpkin seed, are fresh water fish which tolerate somewhat the brackish and sometimes saltier conditions that exist in the Bay today. Other species are anadromous, journeying up through Currituck Sound to reach the relatively fresh waters of Back Bay after months or years at sea. These include white perch and alewife. Yet others, including the silversides and killifish, are at home in brackish water as well as fresh.

How content these and other species are under the prevailing salinity conditions of today's Back Bay is a question that anglers and management agencies have found baffling. In 1962, following

the clarifying effect on Bay turbidity of a 1960 hurricane and its vast inundation of the fresh-brackish Bay with ocean salt water, the City constructed a high-capacity salt-water pump at Little Island Park. The purpose of the pump was to transfer ocean water on a daily basis into the Bay, thereby raising salinity to levels which would assure continued water clarification. Clearer water was associated with better fish and water fowl habitat: improved clarity would mean improved aquatic vegetation which, in turn, would sustain larger populations of game fish and waterfowl.

Evaluation of the Little Island salt-water pumping operation, in water quality and habitat management terms, is one of the important concerns of this report.

Waterfowl are the second-most im-

portant game resource of the watershed, after sports fish, and a resource of beauty and instruction in the ways of nature with form and function, for the non-hunter. The majestic flights of geese grace the late autumn skies and flocks of black, mallard, and other ducks stipple the landscape.

Back Bay serves waterfowl primarily as a wintering habitat; in spring most species fly north to breed and nest. Throughout the year one can find the American coot, solitary by nature, quietly gliding along. In winter, canvasbacks and buffleheads cruise patiently at the surface, waiting to dive to feed below. Canada and snow geese can be seen in the grain fields after harvest, gleaning corn. Whistling swans embroider the waters with their beauty, promenading in faithful pairs.



Putting out decoys, Redhead Bay





Loggerhead turtle nesting habitat throughout beach edge of False Cape.



Osprey nesting, feeding, and resting habitat occurs throughout Back Bay and flood plain.



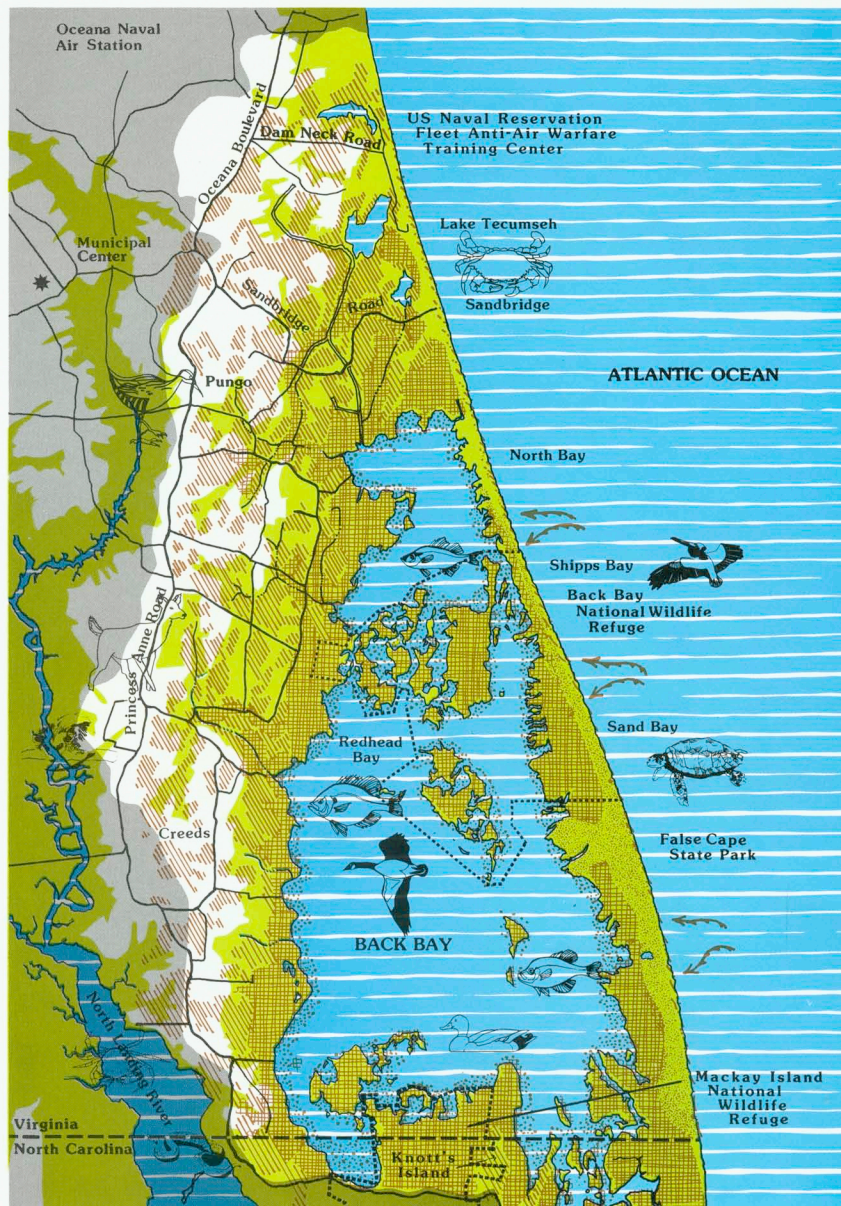
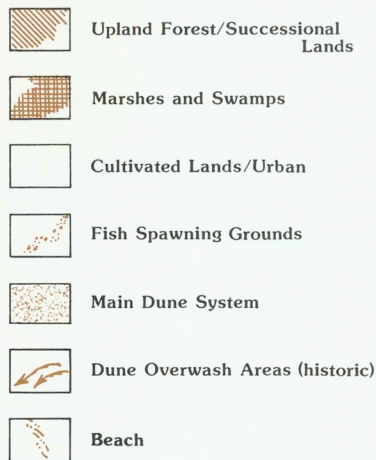
Bald eagle feeding and resting habitat occurs throughout Back Bay and portions of flood plain.



American peregrine falcon feeding and resting habitat occurs on dunes and beaches of False Cape.

source: U.S. Fish and Wildlife Service

## Map 5 Ecological Precincts





Here, too, questions of water quality punctuate the habitat of Back Bay. There has been a serious decline in certain waterfowl populations over the past decade. The average annual waterfowl population in Back Bay was slightly higher than 9,500 in 1972, while in 1976, the average had dropped to 5,600. Peak annual figures for geese show a general decline from an average population in excess of 40,000 in the 1960's to an average of about 16,000 population in the years 1972-1982. And although ducks had reestablished large numbers in the late 1960's and early 1970's, their populations have dropped back to the low levels of the mid-1960's.

What has caused this general decline? Is it periodic, natural, and reversible? Or has something happened through human intervention that has signaled waterfowl to seek out other wintering quarters?

The answers vary, depending upon the species. The lower geese populations in Back Bay may simply be the result of the successes of waterfowl management areas in Chesapeake Bay, the normal wintering termination point for the majority of migratory northern geese. The corn that is planted and left as a standing crop for them in the managed fields of such areas as the Blackwater National Wildlife Refuge 120 miles to the north of Back Bay, further induces the geese to shelter in the Chesapeake, rather than travel further to the south.

Geese know where to find corn and other favorite foods in Back Bay, too. But it may be speculative to imagine that expanded corn planting in the Virginia State Waterfowl Management areas and the two National Wildlife Refuges of the Bay alone would succeed in attracting geese back to the district. Yet, expanded planting may well be worth the try—particularly if grain is planted for this purpose on marginally economical land within the lower elevation flood plains, in the interiors of shallow impoundments that can be flooded in the fall.

Ducks are another story. Their decline along the eastern seaboard is not unique to Back Bay. Dependent heavily on wetland habitat and on lakes associated with wetlands, such ducks as black duck, wood duck, teal, and bufflehead

have diminished in population as suitable habitat has been filled in or drained for development. The decline of the duck population in Back Bay, where marshes and water surface have been kept intact, by and large, may really be the result of the disappearance of duck habitat elsewhere.

Duck decline may also be related to the dramatic decline over the past four years of Eurasian Watermilfoil, an aquatic food plant that, during the 1970's, was the dominant aquatic plant of the Bay. Milfoil provided food to fish and waterfowl, but choked out all other submersed aquatics with its rampant growth. It also proved to be a nuisance and barrier to anglers and boat propellers. The reestablishment of other aquatics that serve as food for waterfowl and fish, by either natural processes or a propagation program, may help determine whether flocks or fisheries will improve in the future.

One of the most inspiring experiences privileged in Back Bay is the sighting of a bald eagle perched on a tree limb or soaring aloft. The majestic raptor is found from time to time in the Bay as a feeding visitor. No nests are known. The rare peregrine falcon is also a feeding and resting visitor on the dunes of False Cape, as are accipiters. The brown pelican is another infrequent migrant. But there are other birds of exquisite character that nest here. The osprey, master fisher with white and gray wings, diaphanous as silk when seen against the sun. The great blue heron, beautiful stalker of the marsh shallows, American bittern, Virginia rail, and greater yellowlegs are among the species which inhabit the marshes and can be readily observed, with patience.

In the scrub/shrub wetlands, slightly higher in elevation than the Bay-edge marshes, the belted kingfisher finds his favorite resting ground. White-tailed deer, opossum, and raccoon feed here as well as in lowland and upland forested areas and down at the water's edge.

Hundreds of other species of wildlife are found, in hundreds of niches throughout the Bay and its watershed: some common, like egrets in a farm field, or rare, like the migratory Arctic peregrine.

Some species are federal and state listed Endangered or Threatened Species

in Virginia: the bald eagle, the peregrines, the brown pelican.

Whether common or Endangered, each wildlife species of the Back Bay watershed adds true value to the ecological, recreational, and aesthetic resources of Virginia Beach. Without this rich diversity of life, the City would be the poorer.









The key to maintaining these resources—and their value to the City—is simply stated: preserve habitat. Without the vegetation, undisturbed physical environment, and quality of water and air that are essential for a healthy habitat, species diversity or numbers, or both, will diminish, as they have already with several waterfowl, mammal, and other wildlife species. The entire Bay perimeter and its wetlands are integral components of the Back Bay habitat system, but so are substantial portions of Pungo peninsula and Dam Neck and Sandbridge area uplands. If habitat is eroded by development in the uplands, Bay perimeter habitat will experience stress and consequent damage to species health, diversity, or numbers.

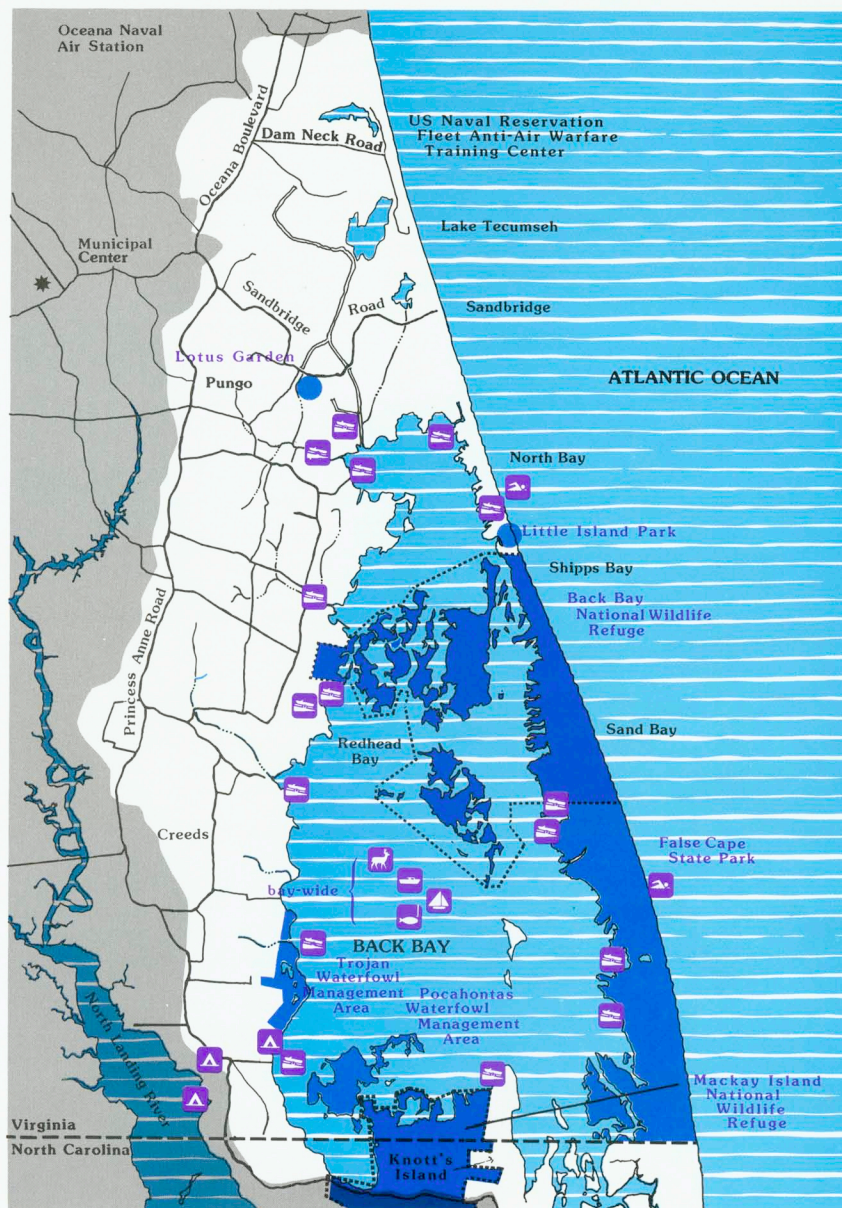
Farm lands and their wooded edges are one part, and an important one, of the Back Bay habitat. Song birds thrive in the transition vegetation between field and forest. Geese and egrets glean leftover grain kernels and feed on other plant life at the field edges. And the farms, so long as they are actively farmed, constitute a non-urban land use that secures the land as undeveloped and therefore non-threatening to birds and other wildlife.

How both the natural and the farmed environments of Back Bay can be better managed to maintain the value of this great resource will be explored on the following pages.



Map 6  
Recreation Resources

-  Fishing/Hunting
-  Boating/Sailing
-  Boat Launch Ramp
-  Swimming
-  Camping
-  Local/City
-  State
-  Federal





# THE CONCISE BACK BAY ALMANAC

## CLIMATE

- **Growing season:** 237 frost-free days, the longest growing season in the Commonwealth of Virginia.
- **Average annual precipitation:** 47 inches.
- **Prevailing wind direction (origin):** Southwest.
- **Periodic hurricane and northeast storm effects:** Shoreline and dune erosion, False Cape overwash.

## LAND AND DRAINAGE\*

- **Soil origin:** Mostly unconsolidated marine sediments, some organic soil, sand in relic ridges and barrier beach.
- **Topography:** Flat lands with most slopes up to 2%, rarely to 7%. Elevations range from about 15 to 18 feet mean sea level on Pungo Ridge, with high points of about 25 feet, to dunes averaging less than 20 feet mean sea level on False Cape, with a few reaching about 65 feet.
- **Drainage:** 8 principal creeks drain into Back Bay:
  - Whiskey Creek
  - Mill Creek
  - Stone Creek
  - Hell Point Creek
  - Muddy Creek
  - Beggars Bridge Creek
  - Nawney Creek
  - Devil Creek

The following drainage conditions continuously effect Back Bay and the watershed:

- North Landing River carries drainage from the west flank of Pungo Peninsula into Currituck Sound, which interchanges with Back Bay at a low rate of exchange.
- Excess wetness problems occur on about 85% of the soils of the Back Bay-North Landing watersheds.

Watershed	Acres	Sq. Miles
Back Bay	66,750	104.3
North Landing River	43,255	67.6
Combined	110,005	171.9

### ● Land Use (Combined Watersheds):

Wooded wetland or swamp	33%
Cropland	32%
Grass wetland	16%
Upland woods	14%
Other uses and upland waters	4%
Pasture	1%

## ● AGRICULTURE

- Number of farms: 664 farms or tracts in about 350 farming units.
- Average farm size:  $\pm$  100 acres
- Primary Crops: Corn, soy beans, winter wheat.
- Other crops: Vegetables, fruit, ornamentals.
- Primary livestock: Swine.
- Swine finished annually: 250,000 (1979 combined watersheds); 100,000 (1982 Back Bay watershed.)

- Other livestock: Limited horse breeding and cattle.
- Total annual manure production: 155,250 tons.

## ● RECREATION

- Numerous Back Bay boat ramps and landings
- Primary recreation areas: False Cape State Park, Little Island Park, Back Bay National Wildlife Refuge
- Angling for large-mouth bass considered the best in Virginia.
- Horticulture: Lotus Garden in Pungo

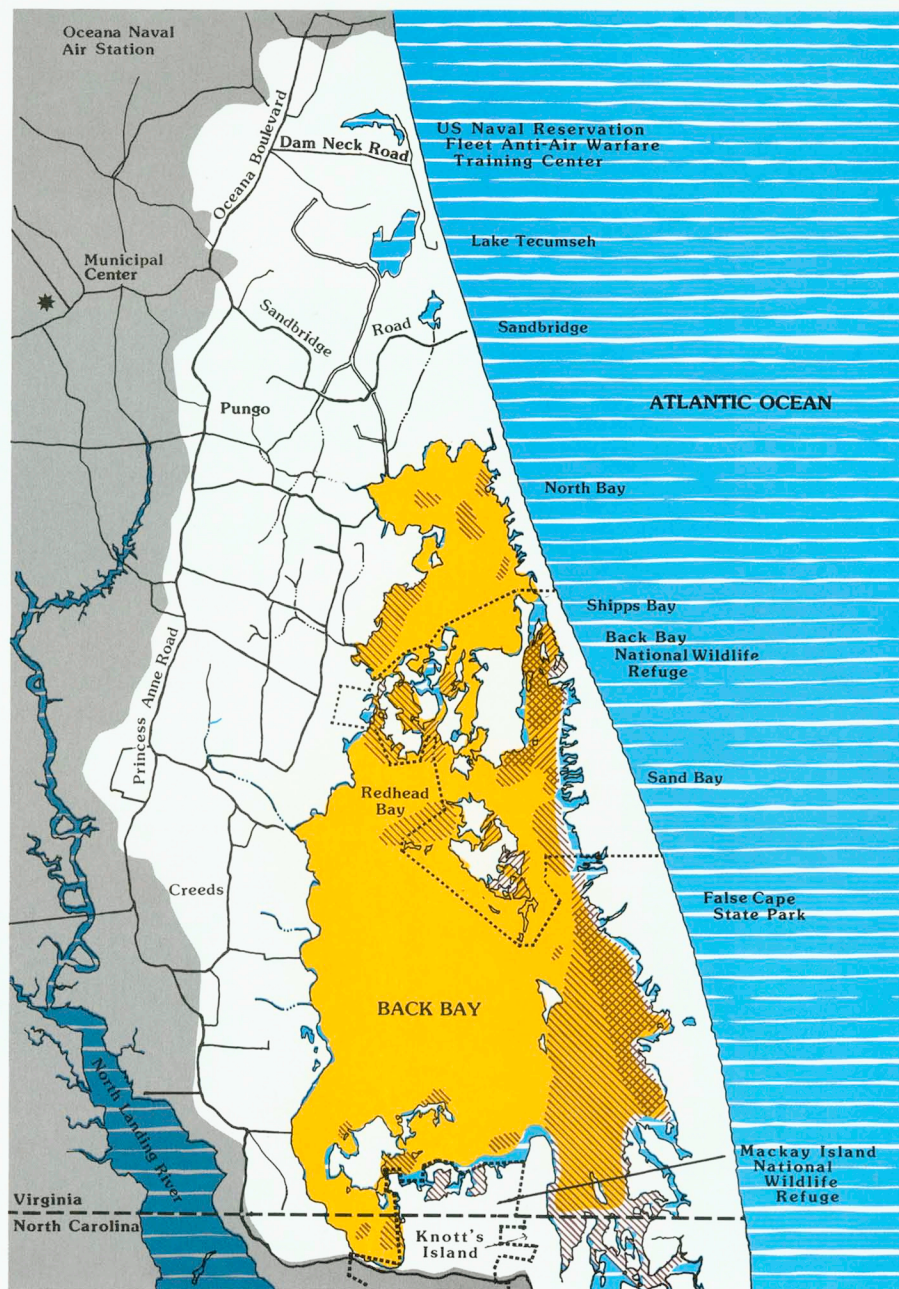
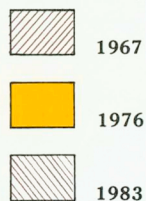
## ● WILDLIFE

- Refuges and management areas:
  - Back Bay National Wildlife Refuge (U.S.)
  - Mackay Island National Wildlife Refuge (U.S.)
  - Pocahontas Waterfowl Management Area (Va.)
  - Trojan Waterfowl Management Area (Va.)
- Threatened and endangered species: Peregrine falcon, bald eagle, brown pelican, loggerhead turtle (Atlantic shore)

\* Note: Unless otherwise indicated, figures are for the combined Back Bay and North Landing River watersheds.

Map 7  
Aquatic Vegetation

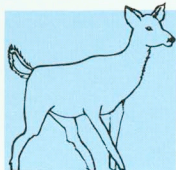
Eurasian Milfoil distribution





## IMPORTANT WATERFOWL, FISH, AND OTHER DENIZENS OF THE BAY

### Mammals



**White-tailed Deer**  
*Odocoileus virginianus*

Largest of the Back Bay mammals, now that bear are no longer found here, this common deer is found typically in upland forest, but also roams bottomlands, swamps, farm fields, and domesticated areas. Also found on several islands.



**Muskrat**  
*Ondatra zibethica*

Building its home in either creek or Bay-shore bank burrows or in above-water houses, the muskrat is found throughout Back Bay. Feeds on aquatic plants.

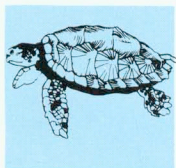


**Virginia Opossum**  
*Didelphis virginiana*

Back Bay's swamps, bordering bottomlands, and upland forest are home to this unique marsupial. Carrying her young at times on her tail, the opossum is not afraid to visit field edges, but depends nonetheless on remoteness of habitat from urban settlement.

Other mammals include raccoon, marsh rabbit, red fox, and nutria.

### Reptiles



**Atlantic Loggerhead Turtle**  
*Caretta caretta*

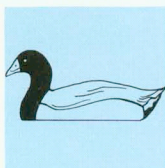
A nesting visitor along the Atlantic beach edge of False Cape, this endangered species is not an actual deni-



**Eastern Cottonmouth**  
*Agkistrodon piscivorus*

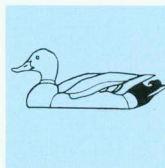
With a dangerous but rarely fatal bite, this venomous snake is found in the scrub/shrub wetlands and lowland forests of the watershed. Feeds primarily on small animals and fishes. Also named the water moccasin.

Other reptiles include the common snapping turtle, northern diamondback terrapin, five-lined skink, rainbow snake, southern copperhead, and eastern timber rattlesnake.



**American Coot**  
*Fulica americana*

Seen as solitary swimmer or in pairs, the coot is a common sight in Back Bay. It feeds on a broad menu of plants, crustaceans, and other small animals.



**Mallard**  
*Anas platyrhynchos*

This common duck is a dabbling, or surface feeder. It tolerates people at short distances in urban parks, but keeps a safer stance on the wilder waters of Back Bay. The green head and white neck-ring of the male are easy identification marks for the species.



**American Peregrine Falcon**  
*Falco peregrinus*

A migrant visitor that feeds and rests in the maritime grassland habitats of False Cape's dunes and overwash areas, this beautiful raptor is a member of the Federal and Virginia Endangered and Threatened Species Lists. The peregrine is tolerant of man but was decimated in past years by pesticides in the food chain.



**Virginia Rail**  
*Rallus limicola*

An inhabitant of the fresh and brackish marshes of Back Bay, this elusive wader runs through the protective vegetation of the marsh in preference to flying. It may move to salt water marshes in winter.



**Canada Goose**  
*Branta canadensis*

Able to walk than ducks, the Canada goose and other geese are a common sight in both bottomland and upland farm fields, feeding on grain and young plants. Next to whistling swans, the Canada goose is the largest waterfowl of Back Bay.



**Bald Eagle**  
*Haliaeetus leucocephalus*

The American emblem, the bald eagle, like the peregrine, is making a comeback to Back Bay, now that DDT and other decimating pesticides have been controlled. Although only seen as a visitor, the eagle is a valued experience for any observer. Basically a scav-



enger, the eagle will less frequently fish in the Bay itself.



**Osprey**  
*Pandion haliaetus*

The osprey, also known as the fish-hawk, nests in dead trees of swamps and flood-plain open fields. Its unique plumage bars and markings in black and white give it a distinctive aura.

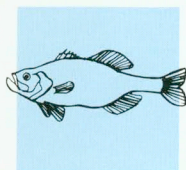


**Great Blue Heron**  
*Ardea herodias*

The largest of the waders, this marsh-stalking predator spears frogs and fish with its stiletto-like bill. Its regal posture, beautiful plumage, and 70 inch wing spread present an awe-some sight to the observer.

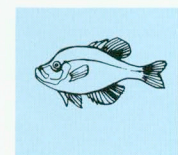
Other birds include many song, wading, and waterfowl species. Among them are the common loon, horned grebe, double-crested cormorant, snow goose, American wigeon, blue-winged teal, pintail, laughing gull, great egret, purple martin, wood thrush, yellow warbler, and many others.

## Fish



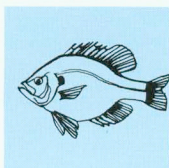
**Largemouth Bass**  
*Micropterus salmoides*

The most sought-after fish of Back Bay, and a favorite angler's game throughout America, the largemouth bass is essentially a fresh water species that is partially adaptable to brackish and saline conditions.



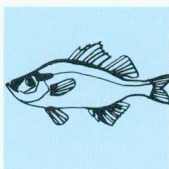
**Black Crappie**  
*Pomoxis nigromaculatus*

This species, like the largemouth bass, is a carnivorous member of the sunfish family. At times



**Bluegill Sunfish**  
*Lepomis macrochirus*

Another favorite angler's target, the bluegill diets on small crustaceans, insects, and other small animals. Its mature length is 8 to 12 inches and it may attain a 1 pound weight.

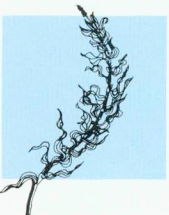


**Yellow Perch**  
*Perca flavescens*

Although not as sought after as the gamier largemouth bass, black crappie, and bluegill, the yellow perch is nevertheless an often-caught fish in Back Bay. It moves to deeper waters during the day and feeds in shallows at night.

Other fish species include chain pickerel, American eel, needlefish, and channel catfish. White perch, alewife, and other salt-tolerant species are essentially marine species adapted to the saline waters of Back Bay. The four species illustrated above are fresh water species tolerant of brackish and some saline conditions.

## Plants



**Eurasian Watermilfoil**  
*Myriophyllum spicatum*

First reported in Back Bay in 1966, this aquatic plant proliferated rapidly, reaching its greatest extent of coverage in the mid-1970's. Today it has significantly declined due to as yet little understood causes. It is a source of food for some fish and waterfowl.



**Sago Pondweed**  
*Potamogeton foliosus*

A highly-prized food plant for waterfowl, this pondweed is adaptable to the brackish waters of the low-saline areas of Back Bay. Its tubers and seeds are the parts sought by feeding birds. It is easily planted for waterfowl management.



**Broad-leaved Cattail**  
*Typha latifolia*

Perhaps the most popularly recognizable of all wetland plants, the cattail is found abundantly along the ditches, marshes and creeks of the watershed. Broad-leaved cattail has a preference for fresh-water environments, while another species of the genus, the narrow-leaved cattail (*T. angustifolia*) has a higher tolerance of brackish water. The plant has little wildlife food value.



**Southern Naiad**  
*Najas guadalupensis*

A favorite of many ducks for its seeds, leaves, and stems, this plant typically grows submerged in shallow waters in the fresh to brackish range. Various small aquatic animals shelter on or beneath these plants.

Among other plants of significance in the Back Bay watershed are other *aquatic and emergent plants*, including wild celery, salt reed grass, reed grass, needlerush, and pickerelweed.

Terrestrial plants include hundreds of species of trees, shrubs, wildflowers, and vines. Among the prominent trees of the watershed are bald cypress, loblolly pine, black cherry, sweetgum, laurel oak, white oak, hickory, and black gum.



## Chapter 3

# WATER QUALITY

[Note to the reader: the following is a brief summary of water quality questions in the watershed. For a full discussion of the subject, read Volume 2: Water Quality.]

Water quality is a major concern of this report and is the fundamental issue in Back Bay. It is also the central key to the broader issue of overall environmental quality in the Back Bay region as a whole. Without improving the quality of water in the tributary streams of the Bay, balancing Bay salinity controls, and improving controls over urban and agricultural run-off within the Back Bay and North Landing River watersheds, more will be lost than the quality of water alone. Habitat areas of watershed uplands, rural character, and other resources will be threatened or degraded. But non-water related impacts could lead to the same kinds of degradation. Large-scale urban development can impact wildlife habitat, too, even if urban storm run-off and sanitary effects were ideally controlled. If this were to happen, we can conjecture, priorities for protection of the two watersheds would be lowered, pollution of watershed creeks would be somewhat more tolerated, and environmental quality would spiral further downward.

One appropriate position to take, therefore, is to adopt those measures that can maintain, improve, and better protect the region's water quality. With this as a keystone of Virginia Beach policy on the Back Bay region, both water quality and environmental quality, overall, will be more fully understood, managed, and enjoyed.

### Changes and Cycles

Water quality characteristics are subject to temporal (time-related), diurnal (daily), seasonal, annual, and even multi-annual changes in environmental conditions, many of which are cyclical in

nature. Where estuarine waters are open to the sea sufficiently, lunar tidal influences are felt several times a day; in Back Bay—too remote from Oregon Inlet—these influences are hardly felt at all. The natural irregularity of rainfall, which averages 47 inches annually in Virginia Beach, creates fluctuations in the concentrations of salt, nutrients, pollutants, and other substances which affect the quality of the waters of the Bay. So does the cyclical nature of the area's climate, of which the annual low flow period of hot late summer is perhaps the most stressful on fresh and brackish waters of the Bay which have been polluted by urban and agricultural run-off.

The changeable and cyclical nature of Back Bay conditions, even without human intervention, guarantees that water quality in the Bay is not fixed and that individual water characteristics may rise and fall in quality in any given time period. Furthermore, the plants, fish, birds, and other wildlife species that depend on narrow ranges of water quality for their health, are sometimes damaged or lethally affected when severe extremes in environmental conditions are reached. Occasionally, such extremes result from exceptional natural events such as hurricane overwash of the barrier beach, which may introduce vast amounts of salt water to the Bay. The Ash Wednesday storm of 1962 raised the salinity of the Bay to 75% of that of seawater, killing many fish and other aquatic life dependent on brackish or lightly saline conditions.

Such changes can be long-lived. The greatest and most enduring changes affecting salinity in the Bay, however, were the natural closing of Currituck Inlet in 1830 and the reinforcement and build-up of the False Cape dune system by the Civilian Conservation Corps in the 1930's. The former cut off regular introductions of sea water by lunar tides; the latter prevented the periodic overwash of hurricanes and severe storms. Both combined

to convert Back Bay into a fresh-brackish estuary which, as explained above in Chapter 2, has favored a wildlife population that differs in many ways from that which inhabited the Bay in earlier days.

### Hydrography, Wind Tides, and Circulation

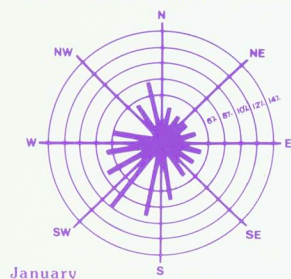
Back Bay's bathymetry (depth) is flat-bottomed and very shallow, with an average depth of 4.4 feet, greater depths of about 7 feet in open parts of the Bay, and depths of 8 to 10 feet in the narrows separating sub-bay waters.

As explained above, lunar tides no longer influence Back Bay in any significant way. But wind-tides do. Wind-tides are not true tides but seiches, or surges of water pushed across a body of water and held at a high level by a strong and prevailing wind. In the winter, with strong winds originating out of a variety of compass points, both north and south, wind tides create high and low water levels with a range of 3.5 feet or more. In the summer, with southerly winds dominant and prevailing, outflow of water into Currituck sound is prevented, water is held back, and although the tidal range is not as extreme as in the winter, water level is held between 1 and 2 feet above mean sea level, on the average, from mid-March to mid-September.

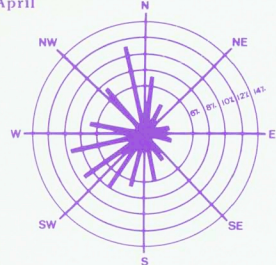
The principal effect of high wind-tides is to inundate the lower flood plains, affecting cropped lands particularly up to the 3 foot MSL elevation.

A second principal effect is a tendency to neutralize the Bay's flushing. Weak to begin with, the flushing rate drops during high wind-tides between March and September, because the prevailing winds from the south and southwest tend to keep water "bottled up" within the bay as long as they blow. Pollution and other water quality problems tend to be more acutely felt in this period.

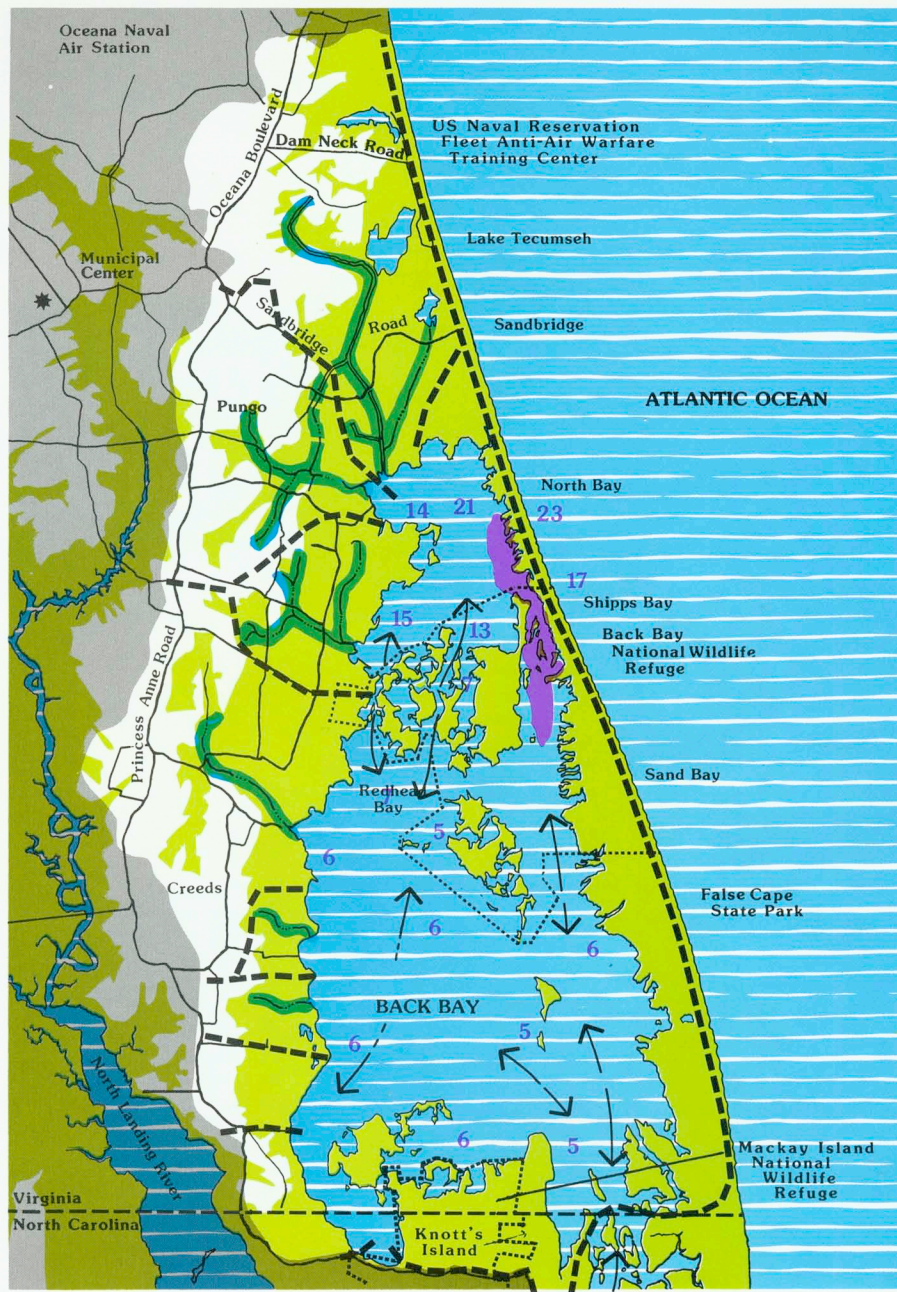
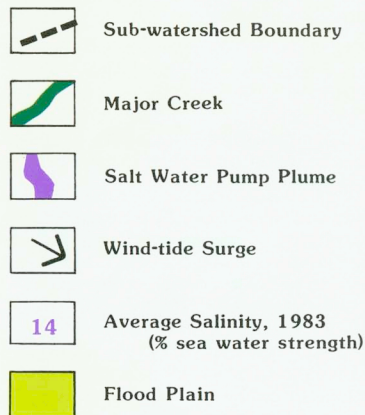
# Wind prevalence/duration



January  
April



Map 8  
**Drainage, Circulation and Salinity**





ered. More specific recommendations on this subject are included in Chapter 6.

## Water Quality and Pollution

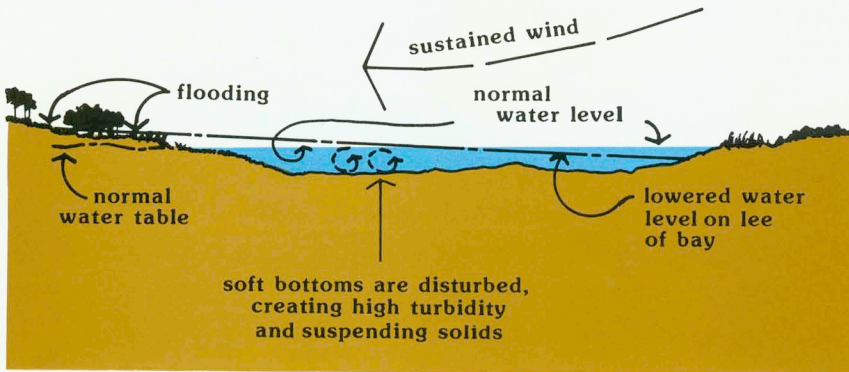
The general quality of water up to the present has been good for the most part, in the larger open areas of Back Bay. Quality has been at times fair to poor at the mouths of the tributaries and within several of the watershed creeks which have been subject to either urban or agricultural run-off, or both.

Run-off carries suspended solids and dissolved material that smothers bottom plants and reduces the photosynthetic capability of the Bay's plankton, on both of which fish and other aquatic denizens feed. In addition, the organic material and nutrients that are either free or adhered to the stream sediments can lead to intensive algal growth, or blooms, which grow to levels beyond the limits of the water environment to sustain them, die, and decay under bacterial attack. The bacteria, unlike the algal plants, require oxygen for respiration, and in their own frenzied activity, severely deplete the water of its dissolved oxygen. The end result of this pollution process is the deprivation of oxygen supply to fish, which die of asphyxiation.

Fish kills result from other forms of pollution attack as well, including the introduction of toxic substances, oil and petroleum products, and disbalances in fish ecology resulting from a variety of changes in water quality conditions.

Few fish kills have occurred in Back Bay over the years. Rapid urbanization of the watershed, however, would need to be rigidly managed and a higher than normal level of pollution control management and enforcement exercised, if the run-off of construction siltation and pollutant discharges typical of urbanizing watersheds is to be avoided. A restrictive management policy regarding urban growth in the watershed would help prevent adverse impacts on fisheries and Back Bay habitat in general.

On the following pages, the question of watershed quality and urbanization will be reviewed. The study will address the question of what Back Bay environ-



## How "Wind Tides" Are Generated

### Salinity and the Little Island Salt Water Pump

The salt water pumping operation at Little Island Park is dependent to a high degree on the circulation patterns and wind-tides of the Bay. Years ago the circulation patterns created by the ebb and flow of lunar tides ensured the dispersion of salt water throughout Back Bay. Without such circulation, the salt-water introduced at the pump line outfall disperses slowly, tending to remain concentrated in a north-south plume (see Map 3).

Map 3 shows salinity figures for both average annual conditions and annual low-flow conditions. During late summer low flow, with water levels and

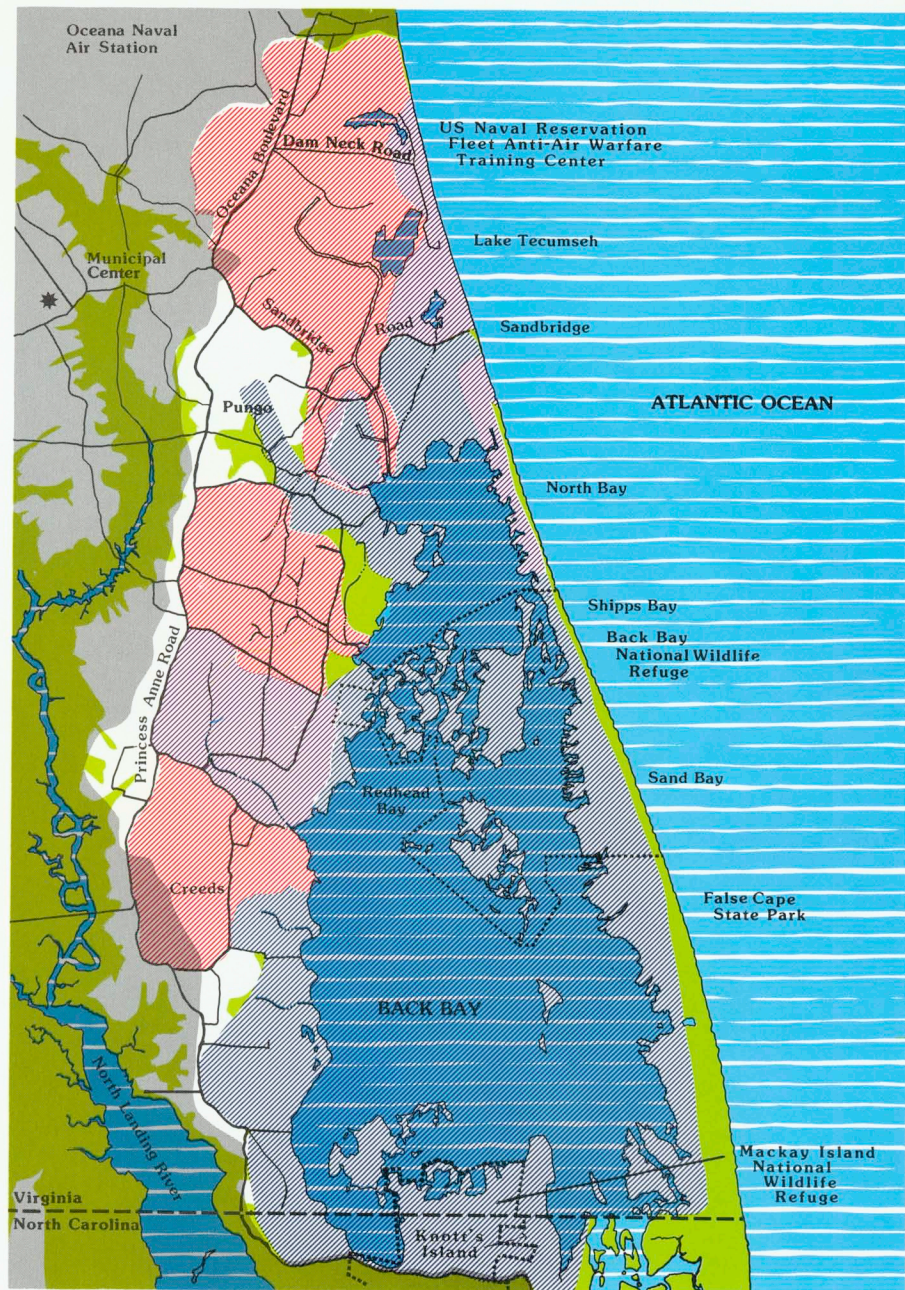
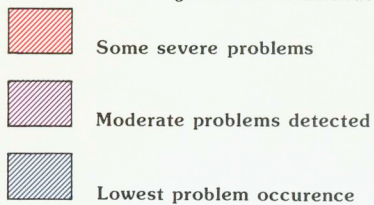
the Bay's flushing rate typically at their lowest, the pumping operation has its strongest effect—perhaps too strong, at 18 percent of sea water strength in 1983 test samples, for the taste of Bay fresh water fish species.

At the south end of the bay, in Back Bay proper, and in the western sub-bay areas, little of the pump operation influence is felt. Obviously, if salinity improvements are to be made, better management of the pumping operation, with schedules geared to seasonal fluctuations in the water budget and with pump line outfall locations matched more suitably to the primary water connections between Shipp's Bay and the southerly sub-bay water bodies—that is, through Great and Little Narrows—should be consid-



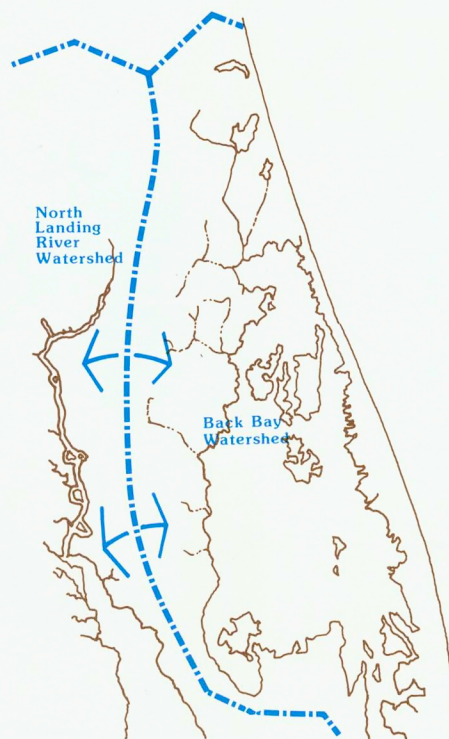
Map 9  
Water Quality

generalized conditions





mental quality is and how that quality might be better protected, enhanced, and managed. Out of it, the people of Virginia Beach may possibly find the information they require to be able to decide whether that "green line" should be held in place, advanced to the south, or adjusted to the north, and what better management tools, if any, ought to be applied to the lands and waters of the region.



A common road system and close proximity of development to Back Bay drainage make the North Landing River watershed portion of the Pungo-Creeds peninsula an important factor in future Back Bay management.

## CHAPTER 4

# THE QUESTION OF DEVELOPMENT

TABLE 1: VIRGINIA BEACH POPULATION GROWTH, 1860–1981

YEAR	POPULATION	CHANGE	ANNUAL % CHANGE	DECADE % CHANGE
1981	272,900	10,701	4.08	52.35
1980	262,199	7,699	3.03	
1979	254,500	10,200	4.18	
1978	244,300	7,900	3.34	
1977	236,400	11,900	5.30	
1976	224,500	6,500	2.98	
1975	218,000	7,400	3.51	
1974	210,600	11,900	5.99	
1973	198,700	10,000	5.30	
1972	188,700	8,300	4.60	
1971	180,400	8,294	4.82	101.96
1970	172,106	3,606	2.14	
1969	168,500	12,400	7.94	
1968	156,100	8,900	6.05	
1967	147,200	9,700	7.05	
1966	137,500	10,400	8.18	
1965	127,100	7,300	6.09	
1964	119,800	8,400	7.54	
1963	111,400	7,500	7.22	
1962	103,900	7,500	7.78	
1961	96,400	11,182	13.12	78.78
1960	85,218	37,551		
1950	47,667	25,083		
1940	22,584	6,302		
1930	16,282	2,656		
1920	13,626	2,100		
1910	11,526	334		
1900	11,192	4,217		
1890	6,975	311		
1880	6,664	1,544		
1870	5,120	1,245		32.13
1860	3,875			

Source: Statistical Development Information Package,  
City of Virginia Beach

water Study Area is the most stable area of the city. The development level has been very low. It is recommended that the City of Virginia Beach seek to maintain this traditional, rural character in this study area . . . The zoning ordinance should be used to allow the type of residential development which is compatible with the current agricultural character of the area, and to prohibit that which is contrary to it." Although the Plan takes a strongly protective stance with respect to the rural lands and flood plains associat-

ed with Back Bay, it also approves light development in the north end of the watershed. The Plan recommendation for the Hell Point Creek area, for example, is 4 residential units per acre (this area is currently zoned "R-8" or six units to the acre).

In addition to the Comprehensive Plan, the City has at its disposal several mechanisms for the public management of growth and development: zoning, subdivision regulation, site plan review, cap-

There is presently little urban development in either the Back Bay watershed or in the areas of the North Landing River watershed that flank the west side of Princess Anne Road on the Pungo peninsula. With the notable exception of the Sandbridge area at the northeast edge of the bay, only a few small communities exist. Pungo, Creeds, Pleasant Ridge, Sigma, and several other small hamlets are rooted in history and largely serve the needs of the district's farm population. Predominantly, land in the watershed is either devoted to agriculture, or lies in a natural state as forest, marsh, beach, and sand dune. The Back Bay vicinity has retained this rural, agricultural character for more than three hundred years in only slightly changing form. However, the very fact that the watershed is largely undeveloped and lies within one of the fastest growing metropolitan areas in the nation, is a challenge to the area's rural character and current land uses.

It is the policy of the City of Virginia Beach, as articulated in the City's Comprehensive Plan and reflected in its programs and regulations, that this rural character should endure in the Back Bay watershed. The City's Comprehensive Plan is the main vehicle for establishing development goals and objectives for Virginia Beach. The Plan defines the major portion of the southern sector of the City, including the greater parts of the Back Bay and North Landing River watersheds, as the Pungo/Blackwater Study Area. The Plan states that "No change in the existing land use of the study area is recommended." Since adoption of this element of the Plan in 1982, City actions on zoning change requests and public facility improvements have essentially followed this criterion.

The Comprehensive Plan further recommends that existing agricultural zoning be retained throughout the Pungo/Blackwater district, and that the region's traditional character be conserved. It states in part that "The Pungo-Black-



**TABLE 2: VIRGINIA BEACH POPULATION DISTRIBUTION**

BOROUGH	1970	1975	1980	1982**
PUNGO*	2,710	2,747	2,783	2,875
BLACKWATER	801	822	893	919
BAYSIDE	50,607	55,015	59,095	62,633
KEMPSVILLE	34,665	62,626	81,544	97,172
LYNNHAVEN	57,841	65,150	75,948	82,258
PRINCESS ANNE	16,211	22,942	33,254	36,847
VIRGINIA BEACH	9,271	8,978	8,682	9,316
TOTAL	172,106	218,280	262,199	292,020

\* Includes Sandbridge

\*\* Estimate

Source: Statistical Development Information Package,  
City of Virginia Beach

**TABLE 3: CHANGE IN PERCENTAGE DISTRIBUTION OF POPULATION**

BOROUGH	1970	1975	1980	1982
PUNGO*	1.57	1.26	1.06	0.98
BLACKWATER	0.47	0.38	0.34	0.31
BAYSIDE	29.40	25.20	22.54	21.45
KEMPSVILLE	20.14	28.69	31.10	33.28
LYNNHAVEN	33.61	29.85	28.97	28.17
PRINCESS ANNE	9.42	10.51	12.68	12.62
VIRGINIA BEACH	5.39	4.11	3.31	3.19
TOTAL	100.00	100.00	100.00	100.00

\* Includes Sandbridge

Source: Statistical Development Information Package,  
City of Virginia Beach

**TABLE 4: VIRGINIA BEACH PROJECTED POPULATION**

YEAR	POPULATION	CHANGE	% CHANGE
2000	417,500	34,800	9.09
1995	382,700	30,400	8.63
1990	352,300	44,700	14.53
1985	307,600	45,401	17.32
1980	262,199		

Source: Statistical Development Information Package,  
City of Virginia Beach

ital improvement programming, and restrictions on construction within the 100 year flood plain. Each of the latter tools must be exercised in a manner consistent with the recommendations of the Comprehensive Plan for each area of the city. These land use "tools" are applied together with consistency to allow the city to grow in a planned, orderly manner that

does not strain public resources. Although they are applied equally to all areas of Virginia Beach, each is utilized in ways that reflect the individual nature of the city's various areas. For instance, the vast majority of land within the Back Bay watershed is zoned for agriculture, while property in Lynnhaven is largely zoned for residential development.

Because the possibility for sizeable residential development in the region is only now becoming apparent, it is timely that the city assess whether or not existing land use tools are adequate to manage growth in the Back Bay area and to maintain its traditional character.

It is possible that the Zoning Ordinance and other land use management tools, as currently constituted, could allow for development which is contrary to the Comprehensive Plan policy of maintaining the rural character of the Pungo-Blackwater area. An analysis of existing land use and planning conditions indicates that four distinct types of new development can be undertaken within the Back Bay watershed:

- o construction of large-scale housing tracts
- o "strip" development along roads
- o large-scale commercial developments such as shopping centers
- o institutional development for intensive uses

### Large Scale Development

A large-scale housing development can be constructed if a developer acquires one of the area's farms or other tracts and is granted a change of zoning, if necessary. Zoning changes are normally granted if the developer complies with all applicable regulations and does not place an undue burden on the city for the construction of public facilities such as schools, sewers, and water systems. Zoning changes are typically requested for higher density development.

While agricultural zoning does restrict the number of dwellings which can be constructed on farmland, farm owners are permitted to build homes on individual lots created from their land holdings. Although utilizing the full potential density allowable under agricultural zoning will not have nearly the impact on water quality and area character of other development types, it will contribute to development pressures generally, reinforcing the trend towards other, large-scale projects.

### Strip Development

Strip development along major roads can occur if the owners of land elect



Urban development in the Virginia Tidewater

to subdivide and sell one acre or larger lots along public rights-of-way to individual home builders. As homes are built, one by one, on these plots, houses would begin to line the roads, irreversibly changing the visual nature of the watershed, even as traditional farming proceeded on the majority of the land. Since strip development would occur at a lower density than tract development, resulting increases in pollution to Back Bay would be less severe, but would occur nonetheless. Traffic problems and new entries and curb-cuts on public streets would necessitate extensive road work and traffic signalization. In addition, the extension of utility lines for electricity, sewer collection, and, where necessary, water supply, would result in a much greater public expense per dwelling unit and per capita than other types of development.

### Large-Scale Commercial Development

While no large-scale commercial center has yet been proposed in the watershed, such a proposal is conceivable in anticipation of development in the Pungo-Blackwater area and to serve the growing population just to the north of the watershed. As residential densities increase in any area, it is certain that commercial and office facilities to support the new population will be developed. Regional shopping malls consume vast amounts of land for commercial floor space and for parking, and require significant alterations to road systems to safely handle additional traffic. The effects of a regional shopping center on the

TABLE 5: PERMITS FOR SINGLE FAMILY HOMES, 1974–1983

YEAR	CITY WIDE	PUNGO BOROUGH	PRINCESS ANNE	UNITS CONSTRUCTED CITY WIDE
1982	2,981	12	517	2,981
1981	1,714	25	305	1,953
1980	1,767	14	173	1,910
1979	2,292	21	437	2,292
1978	2,548	41	607	2,548
1977	3,257	63	839	3,257
1976	2,410	40	358	2,410
1975	1,498	35	290	1,498
1974	1,038	45	147	1,038

Source: Comprehensive Plan,  
City of Virginia Beach

TABLE 6: VIRGINIA BEACH HOUSING STOCK, 1982

TYPE	CITY WIDE	PUNGO/ BLACKWATER
SINGLE FAMILY	58,954	1188
DUPLEX	5,454	4
TOWNHOUSE	11,154	0
APARTMENTS		
LOW-RISE	20,012	20
HIGH-RISE	1,537	0
MOBILE HOMES	2,627	121
BASE HOUSING	12,659	0
TOTAL UNITS	112,397	1133

Source: Comprehensive Plan,  
City of Virginia Beach

watershed's character and the Bay's water quality would be quite significant, resulting in many of the same changes and problems discussed above. It is certain that a large shopping or other commercial center would be inconsistent with the rural character of the Back Bay watershed.

### Institutional Development

Institutional development for intensive uses is a distinct possibility; the watershed is well supplied with relatively inexpensive large tracts in a compatible physical and community environment. While institutional development may potentially be less disruptive than other types of construction, it would reduce the city's agricultural acreage, measurably change area character, and potentially diminish water quality in much the same ways as residential construction. Additionally, an institutional development

might generate more intensive periodic traffic than residential development and could require expansion of the local road network, including Princess Anne Road, and other public improvements.

Urban development, in addition to changing the watershed's character, can potentially add to the pollution of the Bay's waters. Run-off from sites cleared for construction will carry soil into Back Bay tributaries and into the Bay, although on-site soil erosion controls can minimize this effect if well managed. In addition, a larger resident population in the watershed will inevitably result in greater amounts of pollutants from automobiles and oil residues on the roads as traffic increases. As public use of the Bay's shores increases, litter and the erosion of shore banks will increase as well. In addition, the dedication of land to housing and other development eliminates upland habitat and ultimately



**TABLE 7: GROSS LAND UTILIZATION, PUNGO/BLACKWATER**

CHARACTERISTIC	ACRES	SQ. MILES	%
UNDEVELOPED (EXCEPT FLOOD PLAIN)	53,674	83.87	50.98
WATER	23,802	37.19	22.61
FLOOD PLAIN	22,996	35.93	21.84
DEVELOPED	4,812	7.52	4.57
TOTAL	105,284	164.51	100.00

Source: A Study of Housing in Virginia Beach  
Statistical Development Information Package,  
City of Virginia Beach

**TABLE 8: ZONED LAND, PUNGO/BLACKWATER**

ZONE	ZONED ACRES	%	FLOOD PLAIN	%	TOTAL ACRES	%
P-1	8,709	14.89	6,968	30.30	15,677	19.24
AG-1	33,512	57.30	11,947	51.95	45,462	55.79
AG-2	11,450	19.58	4,081	17.75	15,531	19.06
RESIDENTIAL & COMMERCIAL	4,812	8.23	0	0.00	4,812	5.91
TOTAL	58,486	100.00	22,996	100.00	81,482	100.00

Source: A Study of Housing in Virginia Beach  
Statistical Development Information Package,  
City of Virginia Beach

could squeeze many species and wildlife populations away from the Bay's perimeter.

Dense residential and commercial development is filling much of the land in districts just to the north of the Back Bay watershed, and there have been recent proposals to erect housing developments on land lying within the Back Bay drainage system, to the south of Dam Neck Road and along Princess Anne Road. As vacant land available for large-scale residential construction becomes more and more scarce throughout the Tidewater and especially in Virginia Beach, it is certain that pressure to build large tracts of housing and local services in the Back Bay area will increase dramatically. Unless the value of Back Bay's rural nature to the City of Virginia Beach as a whole can be more effectively protected under City ordinances, policies, and programs, the lands surrounding the Bay are likely to be developed and their character changed.

### Development Status of the Back Bay Region

Even as the City of Virginia Beach has undergone a period of phenomenal growth since incorporation in 1962, there has been very little change in either the size of the population or the qualities of the landscape of the Back Bay region. From 1960 to 1980, the population of all of Virginia Beach grew from 85,218 to 262,199, while the population of the Pungo/Blackwater study area grew from 2,997 to only 3,684.<sup>1</sup> Portions of the Courthouse/Sandbridge Study Area lying within the Back Bay watershed have shown less significant recent growth than the portions of this study area lying farther north. Thus, through two decades in which the population of the city as a whole more than tripled, the population of the Pungo/Blackwater study area grew a modest 687, about 18%.

Another measure of an area's growth is the rate at which new households are established. This can be expressed through the increase in dwelling units—houses and apartments together—added

to the area's housing stock in a given period. The Pungo/Blackwater district's relatively slow pace of development becomes even more apparent from an evaluation of changes in the housing stock throughout Virginia Beach. From 1975 to 1982, building permits in Virginia Beach were issued at a city-wide average rate of 4200 permits per year. In the same period, dwelling units have been constructed in the Pungo/Blackwater area at a rate of 17 per year, while dwelling units have been constructed at a city-wide average for the area of 403 per year. These rates are equivalent to approximate increases in density of one unit every 5 square miles of land in Pungo-Blackwater, and 2 units each square mile of land area in the remainder of Virginia Beach.

By any standard planning measure, the rate of development in the southern three quarters of the Back Bay region, as reflected through growth in the Pungo/Blackwater district, has been much, much slower than growth throughout the City. Growth in the northern quarter, that is, in the Courthouse/Sandbridge area of the watershed, has been substantially greater than in the remainder of the watershed.

There are a number of small communities in the Back Bay region: Sandbridge, Pungo, and Creeds, Sigma, Pleasant Ridge, and several other small hamlets. Although it was founded in the last century, remaining a small community, Sandbridge has been developed for resort homes principally over the past two decades, to take advantage of the location's attractive ocean setting. It is the only densely settled residential area abutting Back Bay. Most homes in Sandbridge are oriented towards the ocean and are separated from Back Bay by a series of finger canals and marsh. Typical of other seaside developments, it has been constructed at a very high density, but is fully occupied only in the summer months. Sandbridge represents the southern-most outpost of the Virginia Beach resort area, and further expansion is effectively blocked by Little Island and the Back Bay National Wildlife Refuge, although some open building lots remain.

Pungo and Creeds are both very old settlements which, over the years, have served the needs of the agricultural community and other residents scattered

throughout the watershed. They are larger in population than the other watershed settlements. Creeds supports a school and firehouse. Both hamlets support other services, as well as farm-related businesses.

We have noted that no large housing developments—other than Sandbridge—have been undertaken in the Back Bay watershed. However, as of this writing, there are several proposals to build large numbers of homes within the Back Bay study area, at the site of the Malbon Brothers Hog Farm south of Oceana Boulevard, and at several other sites. Large developments are being constructed close to the watershed's borders, including a very large housing development nearing or under completion at the Red Mill Farm tract near Old Dam Neck Road.

### **Pressure for New Development in the Back Bay Region**

One essential reason that the Back Bay region has retained its rural aspect is that there has been, until recently, ample land available for economically feasible development closer to the city's principal areas of employment and urban activity. Home-buyers and employers have also preferred locational choices close to the urban center. The city's Comprehensive Plan and Zoning Ordinance have also acted to keep the cap on development in the Pungo-Blackwater area, rediverting developer interest to the northern two-thirds of the city. Lastly, the watershed has been relatively free from development pressure because the cost and technical difficulty of providing sanitary waste treatment and drinking water to large-scale residential development in the region have kept the cost of multi-unit construction high, relative to the cost of construction in other areas of the city.

Farm acreage as a whole is falling under land purchases for development. The more than 4400 acres purchased for development in 1983 and 1984 are equivalent to approximately 14 percent of total agricultural lands of the two watersheds. Although some of the land tagged for development is presently woodlot and not active farmland, the trend is apparent; the most productive lands of the two watersheds—currently farmed and conveniently open—are being depleted rapidly. If the trend continues, the present pro-

ductivity and resource qualities of the Back Bay watershed will be radically altered in the very near future.

To help conserve productive farm lands in the two watersheds, better land development controls will be needed, and are recommended for consideration in Chapter 6.

Perhaps the greatest impediment to development in the Back Bay region is the difficulty of providing adequate wastewater treatment to homes in the watershed. It is not impossible to provide this service to isolated single family dwellings. Individual homes on large lots can discharge domestic waste into on-site septic tanks and leaching fields where the waste is purified as it passes through the earth. However, these systems work effectively only if the house sits on land which is high and sufficiently well drained to safely treat the waste without introducing pollution into underground drinking water supplies and otherwise creating a hazard to public health or stresses on quality of the environment.

As the density of development becomes greater, the threat to public health from the use of septic tanks also increases. Traditionally, cities overcome this problem by constructing sewer systems for the collection of domestic waste, and plants for the safe treatment and disposal of the effluent. However, central wastewater collection and treatment systems are a costly public expense; in Virginia Beach, this factor is one reason why city government has, to date, kept urban development to the north of Back Bay.

The Hampton Roads Sanitation District recently opened the new Atlantic Sewage Treatment Plant (STP) at the north edge of the watershed. The plant has the capacity to treat 36 million gallons per day of wastewater. However, the opening of this plant places additional development pressure on the Back Bay area. If the City would in the future reverse its present no-build policy and develop a sewerage network to collect domestic waste from watershed areas south of the Atlantic STP, land in the Back Bay region could be developed at high densities. Builders would, under such a policy change, be more than willing to construct sewage collection systems within their developments and pay to tie into the city's

collection and treatment system because the additional densities permitted by the central sewerage system would make these costs easily sustainable.

A number of changes have occurred, indeed, to threaten the relative stability of Back Bay's rural nature. As vacant buildable property becomes more and more scarce in the districts to the north of the Back Bay watershed, the farm lands of the Pungo and Blackwater districts—nearly 45,000 acres under row crops or supporting hog production operations and other agricultural pursuits—have become the easily identified "new frontier" of open, available land in the city. Residential preferences are also becoming refocused on the attractive rural landscape of the region.

Moreover, the pace of development throughout Virginia Beach is accelerating. Since the recession year of 1979, annual applications for residential building permits have grown from 3,747 in that year to 5,023 in 1982, and exceeded 8,000 permits for 1983. In each year since 1975, more than half of all building permit requests were for the construction of single family dwellings, but demand for attached town-house, garden apartment, and similar multi-unit, planned developments has also been strong. Demand for both new single family housing and new planned communities in the Tidewater is expected to remain strong, and strong demand will cause the price of both land and housing to rise. Consequently, large-scale housing development in the Back Bay area will become more economically attractive and financially feasible.

The 1983 proposal to build more than 2,000 homes at the site of the Malbon Brothers' Hog Farm, the development pressures on such other watershed areas as the abandoned Pungo Airfield, zoned for 12 units to the acre, and proposals for other residential and institutional development on prime agricultural lands, are examples of current developer interest.

High density, large-scale development projects elsewhere in Virginia Beach and other areas of the Tidewater have often been carried out with sensitivity to the environment and with distinctive architectural and landscape design. The same qualities could be achieved by any genuinely responsible development



program in Back Bay. This potential may be beside the point, however. Even the best designed sewage treatment system may be susceptible to flooding, back-up, and overflow, particularly in flat topography such as typifies the lands adjoining Back Bay's flood fringe. Storm drainage systems, moreover, are increasingly stressed as the aggregate area of streets, drives, parking lots, shopping centers, and other impervious surfaces increases. With storms, drain runoff not only increases in total volume, but sharpens in intensity in comparison with unpaved rural lands.

To the extent that urban storm runoff cannot be collected and conducted to central wastewater treatment plants, but must be allowed to discharge into creeks and streams, Back Bay becomes the recipient of all that is washed off the paved surfaces of the urbanizing watershed: automotive grease and oil, litter, and organic and chemical debris of various kinds. In areas under construction, soil runoff and siltation can be expected. Such discharges can be avoided, but at additional public capital improvement cost; typically, most cities would not contemplate undertaking costly storm drainage overflow interception in gradually urbanizing watersheds where the cost per capita of these measures would be very high.

Thus, even under the best planning and design standards for residential and commercial development, appreciable effects of urbanization on the water quality of the feeding streams and waters of Back Bay would be expected. Since, as pointed out in Chapter 3, the water quality of North Bay and its tributaries have already been adversely affected by urban runoff, further urbanization of the watershed could lead to aggravated situations in North Bay and in other sectors of Back

Bay. To date the level of impact has been low, without significant documented effect on fisheries and wildlife. In an urbanizing watershed, however, future impact levels could create serious effects on fisheries, within the highly sensitive ecosystem that the confined environment of Back Bay comprises.

## EXISTING LAND USE MANAGEMENT TOOLS:

### *The Comprehensive Plan*

The Comprehensive Plan remains the most powerful and important tool for managing land use throughout the City of Virginia Beach, and it is the chief expression of the municipality's development goals and policies. The Comprehensive Plan spells out in detail public goals for land use in specific areas of the City, and addresses mechanisms to achieve those goals. The plan is subject to constant review and periodic update and revision, and it must be approved and adopted by the City Council. While its role is discussed in depth elsewhere in this report, it is worth emphasizing that all other land management activities are required by law to be consistent with the duly adopted Comprehensive Plan.

### *The "Green Line"*

The "Green Line" is the boundary between the area the city presently wishes to continue to develop and the area which the Comprehensive Plan recommends retain its rural character. The Green Line runs east along Princess Anne Road to the intersection with Sandbridge Road, and then continues along Sandbridge Road to the Atlantic Ocean. Most of the Back Bay watershed lies below the Line, in the area designated for rural conservation. However, some active farmland and critical drainage features leading into Back Bay lie above the Line.

### *Zoning*

Zoning is the principal mechanism that city government employs to regulate the use of land in Virginia Beach. All land in Virginia Beach is zoned, and all zoning designations must reflect and conform to policies expressed in the Comprehensive Plan regarding the planning district in

which the land lies and regarding city-wide development goals. Zoning defines the specific uses to which any parcel of land can be put, dictating allowances and restrictions on many development characteristics such as residential density, building height and bulk, parking requirements, compatible structures, businesses and activities, signs, et cetera.

The Virginia Beach Comprehensive Zoning Ordinance contains zones covering all standard land uses: agricultural, high and low density residential, apartments, townhouses, commercial, and industrial districts. In addition, the Ordinance contains several special use zones covering preservation districts, hotel and resort hotel districts, resort commercial districts, and planned unit developments. Finally, the Zoning Ordinance is the official vehicle for protecting environmental and cultural resources, including historic and cultural districts, wetlands, coastal primary sand dunes, and the floodplain.

Zoning is not static and is subject to periodic review and change. A land owner can appeal the zoning of a piece of land, seeking a change in zoning if local conditions or city policy militate strongly in favor of the new or revised category. Zoning changes can also be made by the City, in response to revisions of the Comprehensive Plan. All actions regarding Zoning must be approved by the City Planning Commission and by the City Council. Altering the Zoning Ordinance itself—adding a new zone or changing the requirements and restrictions of an existing zone—is a significant action, requiring the consent of the City Council.

The vast majority of land in the Back Bay and North Landing River watersheds, as shown in Map 7, lie in agricultural zones; either "AG-1" or "AG-2." The purpose of these two zoning categories, "is to protect and preserve agricultural lands for the performance of agricultural functions."<sup>4</sup> The legislative intent of the AG-1 Zone specifies that areas thus designated are not intended to accommodate large scale residential development. The AG-2 Zone was created to allow low density residential development in agricultural areas. Far more land in the two watersheds is zoned AG-1.

<sup>1</sup> *Virginia Beach 1983: Statistical Development Information Package*, Virginia Beach Planning Department, May, 1983.

<sup>2</sup> *Comprehensive Plan: City of Virginia Beach*, Virginia Beach Planning Department, 1982.

<sup>3</sup> *Ibid. Statistical Development Information Package*.

Some areas of each watershed is zoned for business and residential development. The Sandbridge area is zoned for fairly dense single family residential development, and there are pockets of land zoned for low density residential and business development scattered throughout the watershed. In addition, several large tracts surrounding Back Bay are designated preservation areas, such as the Back Bay and MacKay Island National Wildlife Refuges, and the Pocahontas and Trojan Waterfowl Management Areas.

### **Subdivision Regulations and Site Plans**

Subdivision regulations are the City's way of assuring that housing developments conform to community standards and requirements, and are applicable any time a single plot of land is divided into two or more plots for the purpose of development. The Subdivision Ordinance specifies standards to which the development must conform regarding streets and sidewalks, sanitary sewers, water supply, public utility easements, drainage, open space, and the preservation of significant features. Subdivision site plans must be approved, in part, by the City Planning Department before any one or more new buildings can be constructed. Site Plan regulations principally govern the physical alteration of a development parcel, off-street parking, on-site utilities, and other improvements. Parcel development is also subject to erosion and sedimentation regulations and urban non-point controls.

### **The Capital Improvements Program**

The City of Virginia Beach maintains a Capital Improvements Program (CIP), which details public expenditure for each of five successive years, on capital facilities and property such as roads, parklands, sewerage, water distribution systems, fire fighting equipment, et cetera. This program evaluates the need for and expense of individual capital projects against the City's fiscal capacity over the projected five year period, recommending a priority list for their implementation. The CIP is a most versatile tool for implementation of the Comprehensive Plan's policies for development and conservation.

### **Restrictions on Flood Plain Construction**

Environmental constraints on development are not frivolous; they help maintain the natural heritage and, most importantly, they protect the health, safety, and welfare of the public. This is certainly the case regarding Virginia Beach Zoning Ordinance restrictions on construction in the "100 Year flood plain."

The 100 year flood plain is the land area which will be inundated by waters from the 100 year storm, also called the "century storm," which is a rainfall that can be statistically expected to occur once every 100 years. There is a 1% chance of a storm of this calculated magnitude occurring in any given twelve months, although there are many instances of communities experiencing more than one 100 year storm in a year. Century storms have struck Virginia Beach in 1933 and again in 1962.

The flood plain is composed of two general sectors, the "floodway" and the "flood fringe." The floodway is the area which contains the normal volume of a river's mean high flow or the normal high water line in a bay, lake, or pond. The 100 Year Flood Fringe is the additional area which is subject to inundation during and after the 100 year storm. The 100 year flood plain, including floodway and flood fringe, in the Back Bay watershed covers all lands at and below five feet above mean sea level—the five foot contour.

It is vital that current restrictions be maintained on construction in both the floodway and flood fringe, including the building of homes and other occupied structures, placement of an impermeable cover such as pavement, and the siting of sanitary waste facilities. In addition, animal waste holding lagoons should be wholly excluded from the flood plain.

Construction in the floodplain places obstacles in the path of moving water, retarding surface drainage, and places an impermeable cap on the land, diminishing the area over which water is absorbed into the ground. Thus, construction in the flood plain actually extends the perimeter of the flood plain onto higher elevations, endangering people, property, and businesses which

would not otherwise be subject to storm water inundation. Construction in Back Bay's flood plain would also diminish the habitat of Back Bay's wildlife and could impair the Bay's water quality.

### **Development in the Traditional Village Center**

The rural village center is as important to the character of the Back Bay watershed as the wealth of natural resources which abound in the region. Growth and development of these hamlets should continue, but should be encouraged to continue in a manner and form consistent with tradition. Planning policies and regulations should encourage infill growth close to the major road crossings where commercial and office development are found today, at moderate densities.

### **ENHANCEMENT OF EXISTING LAND MANAGEMENT TOOLS**

#### **The Comprehensive Plan**

The single most important statement of public goals for the preservation and development of the Back Bay and North Landing River watersheds is the Comprehensive Plan. The Plan is quite specific regarding retention of Pungo-Blackwater's rural character. However, there is ample evidence from recent requests for rezoning of land in the watersheds for intensive residential and institutional development, that a stronger basis is needed to defend the City's planning goals for the lands adjacent to Back Bay.

Consideration could be given to amending the Comprehensive Plan to include a "Back Bay Management District," specifically addressing planning objectives and policies regarding the Back Bay watershed and the lands of the North Landing River watershed that flank Princess Anne Road.

Creating a Back Bay Management District would draw attention to the special nature of the area's resources and the special needs for their protection. It would also serve as the foundation for any possible future measures—several examples of which are discussed below—which the City could implement to assure



better conformance with adopted public goals for the region. Since all activities relating to land use and development must be consistent with the Comprehensive Plan, such strengthening would be the necessary antecedant to enhancement of such municipal instruments as zoning, subdivision regulation, and the Capital Improvements Program.

### **Comprehensive Zoning Ordinance**

In order that the existing rural character of the Back Bay watershed be retained, it would be necessary to manage the density of future residential development. Regulating the density of development is one of the primary objectives of zoning. Consideration should, therefore, be given to making changes to the Comprehensive Zoning Ordinance, especially to altering regulations governing residential construction in the agricultural zones, and to altering certain requirements in some residential zones.

### **Minimum Lot Size**

Rural residential densities can be kept to a modest level by increasing the minimum size of a residential building lot permissible under the AG-1 and AG-2 zones, which are currently 1 acre for each dwelling unit, by increasing the minimum average and frontage requirements to 2 acres and 400 feet for AG-2, and 3 acres and 600 feet for AG-1. A better measure of protection for agricultural lands would be to establish a 3 acre per dwelling unit minimum requirement for both the AG-1 and AG-2 zones.

### **Strip Development**

Increasing minimum frontage requirements can help discourage strip development along public rights-of-way. A reformulated AG-1 zone with a 3 acre minimum lot requirement and a minimum frontage requirement of 600 feet would achieve this objective. In addition to retaining rural character and minimizing traffic impairment and hazards, the large minimum frontages will also ensure that development will be generally discouraged from intruding deeply into farmland to the rear. Road-fronting development meeting minimum standards would penetrate into hinterland only to a 217 foot distance under the new AG-1. Another method to help discourage strip

development is to codify minimum distances between "curb cuts" on public roads from land zoned for agriculture, larger lot residential construction, and commercial properties in the Zoning Ordinance and subdivision regulations.

### **Large-Lot Residential Zone**

Farm owners and others interested in building homes in the watershed request a zoning change for the construction of one or a small number of dwelling units. To enhance their ability to respond to zoning requests, the City may wish to consider creation of a "Rural Residential Zone" for this express purpose. This zone could permit development of a single home on a lot of three or four acres, thus assuring that rural densities are maintained in the watershed. The Large-Lot Zone need not be applied in advance of a re-zoning request, but it can serve as a valid alternative for individuals seeking a home in the Back Bay watershed, with all of the region's traditional characteristics.

### **Spot Zoning**

"Spot zoning" is the zoning of a parcel of land for a use out of character with its immediate vicinity. For instance, the former Pungo Airfield is currently zoned for residential development at 12 housing units to the acre, in spite of its location in an entirely rural setting and the lack of community services such as sewerage, public water, and an adequate road system to support such development. The City Planning Department should consider undertaking a comprehensive review of zoning in the Back Bay and North Landing River watersheds, to find and correct mistakenly spot-zoned parcels. In this way, all land in the planning district will be zoned consistent with local character and the policies of the Comprehensive Plan.

### **Subdivision Regulations**

An enhancement of the current process for considering subdivisions, which would help protect the resources and landscape of the Back Bay watershed—as well as other areas of the city, would be to apply new environmental and visual compatibility criteria in evaluating subdivision applications. With such enhanced criteria, city officials could more benefi-

cally influence the design and planning qualities of proposed subdivisions. Subdivisions that failed to meet the revised district compatibility criteria could be rejected. Examples of visual compatibility criteria might include: consistency or compatibility with Back Bay and Tidewater historic architecture, retention or replanting of tree buffers and borders between subdivisions and public roads, and minimization of signs and above ground utilities.





Further study would need to be conducted to establish precise guidelines for evaluating the effects that proposed housing developments might have upon the environmental and visual characteristics of lands within the Back Bay region. A clear statement of the intent of these new criteria would be codified within the Subdivision Regulations, and specific standards to be used in the consideration of applications falling within the various planning districts can be defined in the Comprehensive Plan.

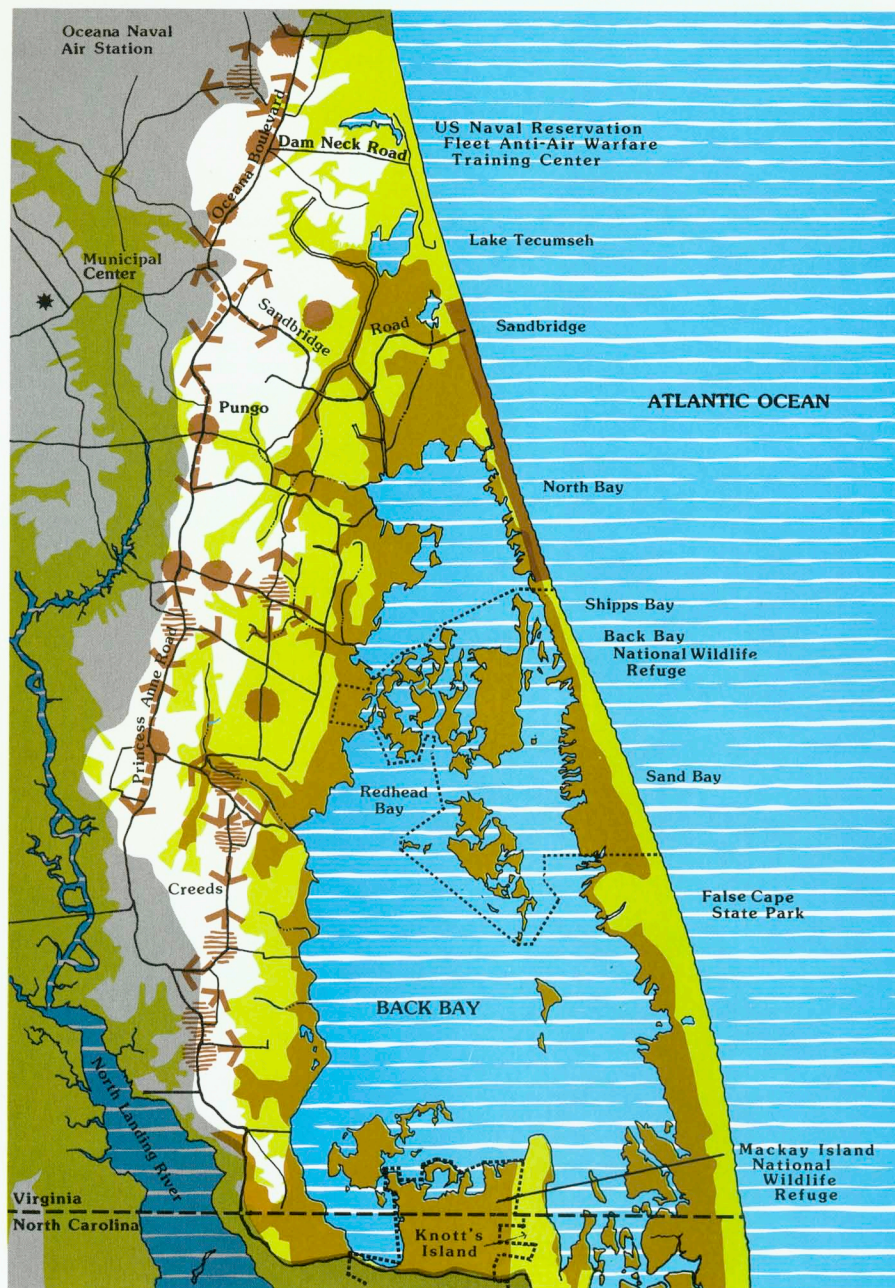
### **Flood Plain Ordinance**

For several years, the City of Virginia Beach has restricted construction in the flood plain. Recently, the sections of the Comprehensive Zoning Ordinance relating to flood plain regulation have been amended to strengthen public control over flood plain construction in the city, including all of the Back Bay watershed. The amended ordinance now restricts filling—raising the land elevation—on areas at the fringe of the flood plain for the purpose of creating a suitable building lot, and it restricts the inclusion of floodway areas in building lots for open space credits in cluster development.

At present, the City's current flood plain zoning and wetlands regulations appear adequate, supported by both City policy and State and Federal regulations. In the long term, however, the perimeter contour of the flood plain will need to be revised to a higher elevation, if scientists' projections of sea-rise are accurate.<sup>5</sup> These projections anticipate a rise in sea-level of almost 1 foot each decade, on the average, over the next 100 years. The immediate cause of the sea-rise is the gradual melting of the polar ice-caps. Under these projections, Virginia Beach can ex-

Map 10  
Development Trends

-  Existing Settlement
-  Potential Development  
(zoning build-out)
-  Potential Pattern
-  Potential Strip Development





pect that the level of Back Bay, as well as the Atlantic itself, may well be more than a foot higher than at present by the first decade of the 21st century.

If true, the flood plain perimeter would need to be set a foot higher; later the elevation would need to be further revised.

This question of sea-rise may need to be considered as a general background issue at this time, rather than as the basis for short-term action. It is recommended, in any event, that caution be exercised in siting dwellings, waste facilities, and costly public structures in the lower elevations, in proximity to the existing 5 foot MSL 100 year flood contour.

### ***Placement of the "Green Line"***

The Green Line separating areas that the City wishes to see develop from areas which are expected to retain their rural, agrarian character, can be realigned to better address conserving the resources of the Back Bay watershed. Several active farms lie north of the Line in both the North Landing River and Back Bay Watersheds, as do certain critical drainage features which contribute water directly to Back Bay. Consideration should be given to applying the same planning policies to these resources as are currently applied to areas below the Green Line because they are just as vital to maintaining the Back Bay region's character and environmental quality.

### **INNOVATIVE LAND MANAGEMENT TOOLS**

Enhancement of existing land use management tools will accomplish a great deal towards protecting the character and resources of the Back Bay watershed. However, innovative steps which significantly expand the City's influence over development and conservation will add effectiveness and efficiency to accomplishing the goals and objectives of the Comprehensive Plan. Following are three proposals for such innovations: "Zoning for Areas of Critical Community Value," creation of a "Virginia Beach Land Bank," and a system for the "Transfer of

Development Rights". Since all require extensive public discussion and significant action on the part of the City Council, following special study and documentation, they are offered as alternatives that deserve public attention and, if appropriate, adoption in either the near-term or far future.

### ***Zoning for Areas of Critical Community Value***

The Comprehensive Plan and existing Zoning Ordinance offer sound guidance for use of the majority of the land in the Back Bay watershed, and ways of enhancing this guidance have been suggested in the previous sections of this chapter. The Ordinance can, in addition, be the vehicle for innovative measures to assure that certain aspects of the watershed's character are preserved and developed consistent with goals articulated in the Comprehensive Plan. In particular, new zones can be created to more precisely address certain watershed aspects and resources, and might include such resources as hamlet centers, historic sites, areas surrounding public boat and fishing access points, uplands adjacent to significant wetlands habitats, and lands adjacent to unique cultural resources such as the Lotus Garden. The new zones could be identified as "Areas of Critical Community Value."

### ***A Virginia Beach Land Bank***

A method for enhancing public influence over the use of land which has been implemented successfully in other jurisdictions, is the creation of a "land bank." The land bank is based upon a revolving fund established to purchase lands that the City feels are important for a particular purpose, as they come up for sale on the open market. The land is then: a) held for development by the City, b) developed by the City for subsequent sale or public use, or c) sold to a specific individual for a specific purpose or development consistent with public goals and objectives. Revenues from the sale of property in the land bank and from use of land and facilities while held in the bank, are returned to the revolving fund.

### ***Transfer of Development Rights***

One innovative land management tool achieving a degree of acceptance and use in other parts of the country is the "Transfer of Development Rights," or "TDR." The idea behind this tool is that development rights are separable from the remainder of the bundle of rights that run with the land. Among examples of the separation of development rights are the granting of utility and scenic easements, air-rights development, and mineral exploration and extraction rights. The transfer of development rights from one parcel of land to another is actually not a wholly new idea, nor entirely innovative. Transfer has been often used in cities to permit property owners to move development rights from parcels where local government seeks to build a public facility to other developable parcels.

Although Transfer of Development Rights has been utilized elsewhere and found to be constitutional by the courts, no jurisdiction within the Commonwealth of Virginia has yet instituted TDR. Thus, the City, if it would consider TDR, should move with deliberate caution and consideration of the effects TDR might have on local conditions relative to state and municipal laws and charters in Virginia.

<sup>4</sup> City of Virginia Beach, *Zoning Regulations*, Section 400.

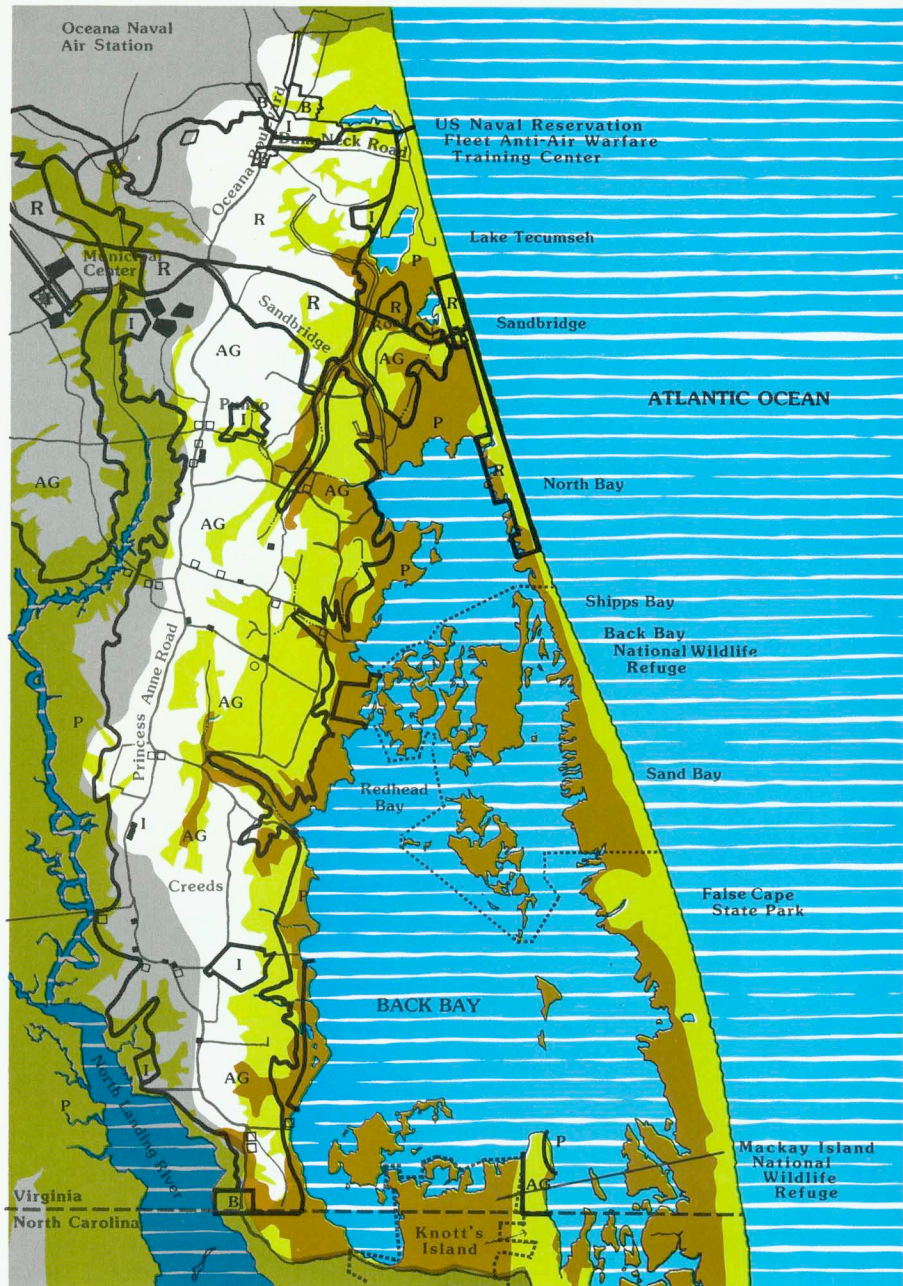
<sup>5</sup> United States National Oceanic and Atmospheric Administration, 1984



Map 11  
Zoning

- AG Agricultural
- R Residential
- B/□ Business
- I/■ Public/Semi-public/Institutional
- P Preservation

Consult Virginia Beach Zoning Ordinance  
for complete zoning data





## CHAPTER 5

# AGRICULTURE

The single most important land use of the Back Bay watershed and the adjoining lands of the North Landing River watershed is agriculture. Earlier centuries witnessed varied crop, livestock, and pasture uses as settlers first developed subsistence farming, then market produce to meet the needs of tidewater towns and cities, and experimented with agriculture and related pursuits that could meet regional and national markets.

Agriculture today is concentrated on two related activities: the raising of hogs for market and the growing of grain—principally winter wheat and field corn—and soy beans. These field crops are used in part to satisfy the feed requirements of local livestock. Feed preparation, storage, and distribution businesses are an important segment of the Virginia Beach farm economy, as are fertilizer, pesticide, and insecticide distributors and distributors and service shops for farm equipment. There is also some horse-breeding and the raising of other livestock, but these are minor in comparison to hog production.

No slaughterhouses or packing plants exist within the watershed. Finished hogs are shipped elsewhere in the region.

Undoubtedly, the farm economy of the Pungo peninsula has contributed positively to the overall economic well-being of Virginia Beach, while providing diversity within the natural and cultural landscape of the city.

Production levels have varied greatly over the years, rising or falling in response to hog market futures and wholesale prices. Today, however, pressures for urban development on the northern tier of the Pungo peninsula have threatened to take their toll on both livestock production and areas of productive farm soils. During the 1983-84 study period, several major residential developments in the Pungo-Sandbridge Road area, Nimmo Church and Princess Anne areas, and a large-acreage institutional development in the North Landing River watershed were proposed, following purchases involving a total of close to 4400 acres of land (See also Chapter 4: Urban Development). Hog production and acreages of land in active farming are shown in the tables below:

The 1985 estimated totals reveal the impact of the sale of farm land for development on agricultural production in Virginia Beach. Hog production will fall principally because the Malbon Brothers Hog Farm, with 20,000 finished head per year and until now, the largest producer in the city, has been sold under one development project. On the other hand, market prices have been attractive, and most producers have increased the number of head on their farms.

### Cropland Erosion and Cultivation Practices

Another form of loss of productive soils is the erosion of soil from croplands, ditches, and other farm areas.

Map 8: Soils indicates the general location of soil groups of the Back Bay watershed, identified in terms of their drainage and productivity characteristics. (Note that **soil productivity** is the measure by which a given soil contributes to overall crop yield, whatever the source of nutrients. Productivity is thus distinct from **fertility**, which is the measure of the actual nutrients and organic matter inherently held by a given soil).

The environmental damage to Back Bay that is caused by soil erosion—loss of water clarity, introduction of fertilizers that can cause algal growth and oxygen-depleting decay, introduction of pesticides, and coating and “suffocating” of the Bay bottom—are discussed in depth in Chapter 3: Water Quality and in Volume 2.

Land and soil conservation measures and other “best management practices” as recommended by the U.S. Department of Agriculture, State Water Quality Board, and Hampton Roads Water Control Agency will minimize cropland erosion. Two of the more effective measures are “no-till” and “modified till.” The former technique consists of leaving the residue of a harvest untouched—not plowed under as routinely practiced in common cultivation—and seeding in the next crop directly through the residue with an adapted seed drill. The practice has recently become popular with many farmers, including a number in Virginia Beach, but was actually introduced in the 1930’s during the Great Depression. The purposes of no-till are to conserve soil moisture by not turning the soil, minimize soil erosion, and conserve equipment fuel and labor.

“Modified till” or “conservation till” practices are fashioned to achieve the same objectives, but are more suited to soils whose moisture content is too high to permit leaving the land unturned. Under modified till, listing and ridge planting, chisel plowing, and light disking are

TABLE 9: HOG PRODUCTION AND FARM ACREAGE, 1975–1985

Hog Production Virginia Beach			Farm Acreage Virginia Beach (nearest 1000 acres)		
1976	1982	1985 (est)	1979	1982	1985(est)
250,000	100,000	95,000	36,000	32,000	28,000

employed since these techniques allow crop residue to remain at the surface, even as the subsurface is tilled.

Yields are usually higher under no-till and modified till. This fact may help to extend their adoption by watershed farmers.

Another source of soil loss is the practice of many farmers of cultivating fields right up to their side edges. This practice and the leaving of inadequate room for equipment turn-around at the field ends inevitably lead to sloughing off of soil into ditches by equipment. Leaving planted buffer strips at field side edges and allowing adequate space at field ends, with a planted buffer strip there as well to slow down field run-off and thus reduce ditch erosion, are valuable measures for watershed farmers to take up.

Where rotary high-volume, large-nozzle "gun" type irrigation is practiced, care should be exercised to prevent irrigation spraying of the field edges close to ditches, since droplet impact can erode ditch sides and shoulders.

### Fertilizer Applications

Commercial crop production in the two watersheds rely heavily on fertilizer applications. Averages of 55 pounds of nitrogen and 20 pounds of phosphorous are applied annually to each acre of farmed land. Most of this is absorbed by the soil and subsequently by crop plants or pasture, and by soil flora. Some, however, is washed away into ditches and creeks and, ultimately, into Back Bay. Causes of excessive loss of nutrients—the term given to nitrogen, phosphorous, and other metallic elements because of their function in plant growth—include excess fertilizer application, overspraying of liquid fertilizer into ditches, rainfall washing away recently applied fertilizer, and farming of poorly drained soils or of land too low in elevation—either or both of which factors will prevent nutrient absorption into the soil and allow its running off into the Bay.

Improved practices include careful measuring of fertilizer applications to match the absorptivity of the soil in question, avoidance of overspraying into ditches, and enhanced management of fertilizer applications on the most poorly drained soils and on lands low in the



**Cropped land and hog production near Pungo**

flood plain. Restricting the use of gun type irrigation devices for fertilizer applications, or carefully setting them to avoid ditches, will help to eliminate overspraying. The Payment-in-Kind (PIK) Program of the U.S. Department of Agriculture has been effective in encouraging the voluntary setting aside from production of worst-drained soils, including low flood plain lands. All such measures, if adopted more widely, will help to decrease nutrient run-off and water quality damage in Back Bay.

### Ditch Construction and Maintenance

Preparation of ditches and maintaining them are also vital to soil erosion control. Proper angle of cut and side slope compaction are essential. An Italian make of ditch-cutting equipment in current use in the watersheds achieves these objectives easily.

Immediate planting of the ditch sides and bottom with fescue, lespedeza, or other conservation plants is essential to ensure that root growth is given a quick chance to stabilize the ditch cuts.

Fescue, being tall and coarse, constitutes good wildlife cover. Mowing in late spring will control woody growth; leaving the fescue unmowed in the fall will provide wildlife the additional winter cover they seek at field side.

Careful maintenance of tie drains and lateral, lead, and main ditches is necessary. Timely clearing of ditches and spreading of removed silt back on the field will catch eroded soil before it reaches Back Bay.

Installation of detention ponds, weirs, or other flow control devices on main ditches can reduce velocity and retard soil runoff.

Careful disposal of all ditch and pond spoil, spreading of spoil, and vegetative stabilization are all measures that can control soil loss.

Use of weirs and other level-controlling devices can also be used to ensure that nutrients do not wash away during light or moderate rainfall. The devices, installed in main ditches, are adjusted to hold back field water and to release it slowly. The level-controlled, nutrient rich



water works backward, keeping ground water higher and helping to increase crop yields.

### Livestock Waste Management

The hog production of Virginia Beach has been among the highest in the Commonwealth of Virginia during the past decade. In recent years production has declined, as shown in Table 9. Current levels still constitute a significant agricultural enterprise and economic contribution to the city, however.

Over the years, the art of raising swine has changed considerably from open or woodlot pig farming to today's wholly enclosed operations, in which pig litters are farrowed, raised, and finished as market hogs without ever pasturing in an open field. Some operations include open feedlots attached to the hog houses. In both cases, animal wastes are generated that must be contained and prevented from entering surface waters and ground-water supply sources. The facility used for containment is the holding lagoon, an excavated pit with diked sides of sufficient capacity to handle waste inflow between disposal operations. Disposal is accomplished by on-land application, either through spray irrigation or by use of "honey-wagons," on crop-land or pastures.

The National Pollution Discharge Elimination System requires certification of waste-handling facilities that no discharges to surface waters are allowed by the waste generator. In the Commonwealth of Virginia the State Water Control Board is responsible for reviewing and approving proposed animal waste holding lagoons and for issuing "No Discharge Waste Handling Certificates" to owners of lagoons that meet established criteria. Among these criteria are evidence that the soil to be used for the lagoon dikes will not erode or slough, that seepage through the dike will not occur, and that a floodable site is not used. (A full description of permit/certificate requirements is provided in Publication ME-81, "Regulation of Agricultural Wastes", available through the SWCB or local Agricultural Extension office).



### Holding Lagoon Design

Lagoon size must be calculated to meet swine production sizes and built to careful specifications. Settling basins are sometimes constructed between hog houses and lagoons to let manure solids settle out. This step allows the conserving of capacity in the lagoon and makes pumping out easier through small diameter irrigation equipment.

Infiltration areas are acceptable for small producers as a substitute for holding ponds, but only where topography is essentially flat, soils are of suitable permeability, and wide vegetated buffer areas exist between the infiltration area and the nearest ditch or other water feature.

Lagoons must be built with dikes in the Back Bay and North River Landing watersheds because interior seals must be protected from groundwater intrusions when the lagoons are pumped for land applications. The dikes must be built with soils of low permeability and erodibility. They must also seal easily with animal waste sediment; as the lagoon fills for the first time, sediment is

deposited and provides the seal which prevents seepage of wastes into the surrounding groundwater.

Dikes must also be of a shallow enough slope, particularly on the exterior, to prevent rain-induced erosion and sloughing, which can lead to collapse of the dike. Erosion of dikes and of excavation spoil mounds also results in sediment run-off and deposition in the creeks and waters of Back Bay. Careful dike construction and immediate grassing of both dikes and spoil berms are essential for preventing this degradation.

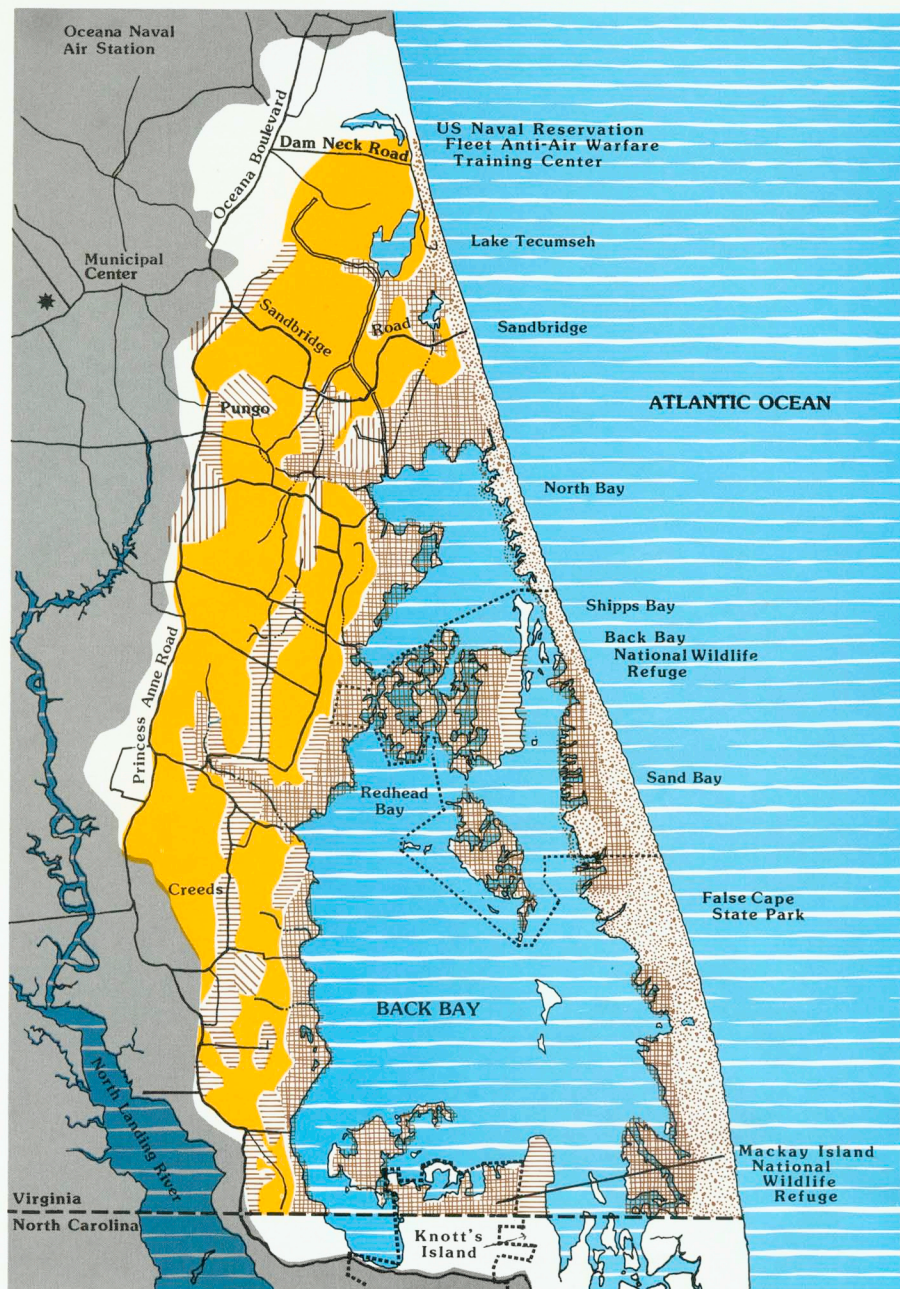
To allow sufficient excess capacity to accommodate rainfall as well as animal wastes, a zone of 1-1/2 feet is provided above the maximum operating level in the lagoon, to provide for 24 year- 24 hour storm water storage, and adequate free-board.

### Problems

Overall, holding lagoons in the two watersheds have succeeded in containing animal wastes. Pollution control and agricultural extension advisors believe that the lagoons are being effectively man-



Map 12  
Soils



source: U.S. Soil Conservation Service



aged, as a rule, but there have been exceptions. Two owners have been cited by the courts for allowing waste discharges from their lagoons into adjacent creeks, and other instances have been noted of possible seepages or siphoning off of lagoon liquid from brim-full ponds. During the course of the present study, high nitrogen levels were detected in creeks downstream of hog farms; high nitrogen, however, could be attributed to area croplands, from which nutrient run-off is generally more significant than from hog operations.

Nonetheless, animal waste management in the watersheds can still be rated as less than complete. Spray irrigation gear for on-land application of lagoon liquid is known to be in use by only two of the area's 20 or so major hog producers. Use of honey wagons or manure spreaders for the spreading of wastes is problematic and unreliable because of their high labor and equipment-time costs. In addition, wetness of field soils in the Spring, prior to planting, and in June, between wheat harvest and summer crop planting, can force a farmer to omit waste spreading by the heavy vehicles. If spray irrigation gear is not at hand, the wastes may not be field spread. The short time interval following June harvests also discourages farmers from either spraying or field spreading.

A further complication is that the nitrogen content of wastes held in the lagoons drops fairly quickly, with a loss of about 70% during a single season. Lagoons function with anaerobic bacteria, which convert ionized nitrogen to volatile ammonia. The loss is not beneficial in terms of farm economics, since the lower N content makes on-land disposal less cost-effective and a less desirable alternative to store-bought fertilizers.

The operational problems farmers face with respect to waste management could be partially alleviated in several ways.

Cooperative purchasing and sharing of spray-irrigation equipment could make on-land disposal an easier alternative for many farmers, especially small and medium sized producers.

Construction of a secondary lagoon adjoining the first could alleviate storage capacity problems. Also, the higher nitro-

gen content wastes of a smaller primary pond could be used as a higher-valued fertilizer, leaving the larger secondary pond to serve essentially as a storage facility.

Settling basins could also be pumped directly to spray irrigation systems to take advantage of the higher N content of the fresh manure, with lagoon water used for sufficient dilution. Any other measures that would increase the use of fresh animal wastes at low cost and with no adverse impact on the environment would be similarly beneficial.

Dikes and spoil berms or mounds should be immediately grassed and routinely maintained to prevent erosion and sloughing.







## CHAPTER 6

# MANAGEMENT

This study has examined closely many aspects of Back Bay and its watershed, assembling a picture of how the various processes—physical and economic—interact in creating the complex natural and cultural environment that exists. While water-quality, operation of the Little Island salt water pump, land development, aquatic vegetation, changes in waterfowl populations, and agricultural practices have each been the subject of close scrutiny, care has been taken to decipher just how each of these subjects contributes to the entire bay and watershed system.

The study indicates that the natural resources and character of the Back Bay watershed are in very good—but precarious—condition. There are some signs that natural resources are suffering some degradation, such as the retreat of aquatic vegetation and diminishing flocks of waterfowl, and even stronger hints that the watershed's upland habitats and character are being challenged by increasing pressure from urban development. Until recently, there has been no serious threat to either the natural environment or the rural, agrarian aspect of the watershed. However, the phenomenal growth and development of the City of Virginia Beach signal that habitat destructive change in the watershed is imminent if management of the region's resources is not enhanced.

The findings of the study suggest that a number of management topics must be addressed if the character and resources of Back Bay and the watershed are to be preserved. These topics are:

- Urban Development
- Flood Plain Regulation
- Water Quality and Salinity Control
- Control of Erosion and Sedimentation
- Agricultural Practices

### ○ Recreational Impact Management

#### THE QUESTION OF DEVELOPMENT:

Several basic alternatives are possible with respect to the degree of control the City may exercise over development in the watershed and the related undeveloped lands of the North Landing River watershed. The ultimate answers may be found not in a single alternative, exclusively, but in several. Attention is urged to each of the following, and to the recommended synthesis with which they are

- Land Management Enhancement Strategy
- Improved Land Management Tools Strategy
- Protective Management Strategy

The "Land Management Enhancement Strategy" relies on enhanced operation of existing planning and regulatory activities. This approach requires no new initiatives on the part of the City Council and no new administrative programs. The Land Management Enhancement Strategy calls for increased vigilance in support of the Comprehensive Plan policies regarding the Back Bay area and for closer coordination of routine municipal actions with those official policies.

The "Improved Land Management Tools Strategy" builds upon the Land Management Enhancement Strategy and entails the enhancement of existing municipal programs such as zoning, subdivision review and approval, property tax assessments, and health code regulation. Although the Improved Tools Management approach requires the creation of no new municipal programs or powers, it does rely on administrative action by several City agencies and the City Council. It

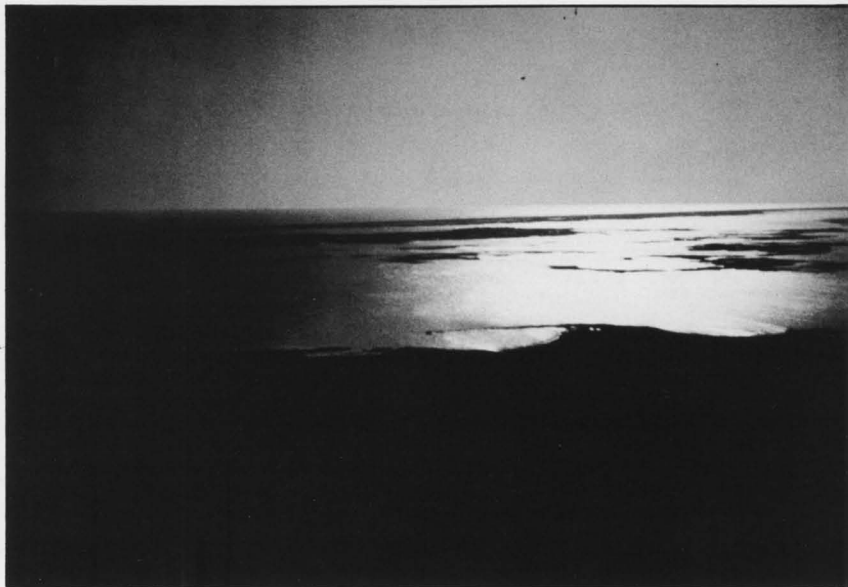
does not require the adoption of any new programs by the City Council.

The "Protective Watershed Management Strategy" goes beyond both of the other approaches, introducing new programs and powers for City government to augment existing zoning and other tools. Certain of the Protective Watershed Management recommendations, such as Transfer of Development Rights and the Land Bank, are innovative, but they have all been successfully used by other jurisdictions elsewhere.

**THE LAND MANAGEMENT ENHANCEMENT STRATEGY** would be fully consistent with existing policies and actions of the City and would continue its modest level of control over development in the watershed. Principally, this approach maintains the status quo regarding development in the Back Bay watershed, with some minor planning enhancements to assure better implementation of current City policy.

#### Land Management Enhancement Strategy Actions

- Undertake a study of the Planning Department's "Green Line," to consider extending the line northward at selected points, to protect prime agricultural soils, critical watershed drainage areas, and upland wildlife habitat.
- Retain existing zoning in the Pungo-Blackwater Study Area, and those portions of the Courthouse/Sandbridge Study Area which lie within the Back Bay watershed. Most of this land is currently mapped as Ag-1 and Ag-2. All applications for rezoning would continue to be considered under current Comprehensive Plan criteria.
- Amend "spot zoning" throughout the watershed. Certain areas, such as the abandoned Pungo Airport,



currently zoned for development at 12 units to the acre, are inappropriately zoned and are inconsistent with the Comprehensive Plan.

- Review subdivision applications by current criteria and policies articulated in the Comprehensive Plan.
- Maintain the current capital improvements schedule regarding the Back Bay and North Landing River watersheds. No extensions of municipal sewerage or water lines would be scheduled for the watersheds within the planning future.
- Require certification by residential and commercial developers that they will adhere to urban development best management practices and erosion and sedimentation controls.
- Develop a home owner education program regarding the safe and clean operation of individual septic tanks, fertilizer application, and toxic home chemical disposal.

#### **Land Management Enhancement Strategy Results:**

- Gradually, available land for residential and commercial develop-

ment in the Courthouse and Sandbridge areas will be built out. The attractiveness of the undeveloped land will increase.

- Land values in the Back Bay watershed, being low relative to the rising value of land in the urbanizing areas of Virginia Beach, would attract increasing pressures for zoning variances and rezoning to allow large scale and individual residential construction.
- Scattered large-lot residential development along public rights-of-way in the watersheds would continue, and the pace may quicken. Demand and political pressure for residential zoning and public facilities in the Pungo and Blackwater Boroughs will increase.
- The number of active farms in the Back Bay watershed will diminish and the number of acres devoted to crops and animal husbandry will continue to erode.
- The encroachment of residential development on flood plain areas could potentially threaten public

safety and water quality in Back Bay.

- Gradual development of the watershed will reduce upland wildlife habitat and encroach upon the habitat of Bay species.

**Land Management Enhancement Strategy Evaluation** This approach will delay, but not turn back gradual urban encroachment of the Back Bay watershed, neither will it enhance protection of the area's natural resources and agricultural heritage. However, all actions recommended under the Land Management Enhancement Strategy can be accomplished without expanding existing municipal programs or authorities.

#### **IMPROVED LAND MANAGEMENT TOOLS STRATEGY**

This approach offers stronger control over development. The approach requires the amendment of certain regulations and policies, but does not require the creation of any new authority or regulatory action.

#### **Improved Land Management Tools Strategy Actions**

- Amend the Comprehensive Plan to create a new "Back Bay Management District" to articulate goals, objectives, and policies for development and resource conservation. The district should extend to all Back Bay watershed lands and waters, those of the North Landing River watershed flanking the Pungo Peninsula, and the Atlantic shore.
- Amend the Zoning Ordinance to create new zones to protect forests, primitive lands, and productive agricultural soils of demonstrable community value within the Back Bay Management District. Prepare a city-wide inventory of lands having "demonstrable community value," and revise the Comprehensive Plan to reflect the special resources of each planning district within the inventory.
- Revise the existing "Ag-1" zone to restrict maximum lot depth and to expand side yard requirements. Retain all other zones in the ordi-



nance as they currently appear.

- Seek the Commonwealth's assistance in strengthening health code restrictions on the use of individual, on-site waste treatment systems for new construction of individual homes.
- Prepare a study of and program for applying environmental and visual compatibility standards to subdivision application review and approval as detailed in Chapter 4. Such standards could be incorporated into the Comprehensive Plan on a district by district basis.
- Reduce front foot property tax assessments for productive agricultural lands, to enhance the preservation of active farms.
- Establish a "Public Lands Trust" to which open space lands can be donated, free of inheritance tax, for municipal ownership, preservation, and public enjoyment.
- Adopt other measures defined under the Land Management Enhancement Strategy.

#### **Improved Land Management Tools Strategy Results**

- Modest retention of present day watershed agricultural character and land use, with increased protection for unique community resources. Roadside "strip" development of agricultural lands for individual homes will continue.
- Relative enhancement of land values in the Courthouse and Sandbridge districts and incentives for higher density development in areas outside the Back Bay watershed.
- Development will respond primarily to market pressures, but with increasing pressure for rezoning for residential and commercial development in the watershed.

**Improved Land Management Tools Strategy Evaluation.** This approach increases the level of control that the City can exercise over development in the Back Bay watershed. It also creates addi-

tional incentives for the preservation of agricultural lands and encourages development in areas beyond the watershed which have been designated for higher residential densities in the Comprehensive Plan.

#### **PROTECTIVE WATERSHED MANAGEMENT STRATEGY:**

This is the strongest of the three strategies considered for controlling development and resources in the Back Bay watershed. Its actions require, in some instances, the creation of new powers by the Virginia Beach municipal government, but all new powers fall within the City's mandated responsibilities. Three of the recommended actions comprising the Protective Watershed Management Strategy are innovative land use tools: "Zoning for Areas of Critical Community Value," "A Virginia Beach Land Bank," and "Transfer of Development Rights." Each of these tools was introduced in Chapter 4: The Question of Development; they are discussed in greater detail below.

#### **A Back Bay Management District**

Also recommended under the Improved Land Management Tools strategy, this step would establish defined policies within the Comprehensive Plan that would guide the adoption of new and improved tools for the protection of Back Bay and its upland resources. It would allow the City to more directly relate specific development proposals and zoning change requests to the City's updated policies for Back Bay.

#### **Zoning for Areas of Critical Community Value**

Although this report has laid out basic findings on resource value, further identification of specific resources and their locations would be a valuable management step. Such a study should be undertaken by the Planning Department to identify areas and resources throughout the City which have special environmental, historic, and cultural importance. The Department's study would also include the development of standards which could be applied in evaluating the critical value of an area or resource proposed for designation. These areas and

resources could then be included in the Comprehensive Plan, within a Back Bay Management District, along with goals and recommendations for their protection and development. Finally, a new zone could be adopted under the Zoning Ordinance, which would cover such Areas of Critical Community Value, specifying management steps and restrictions for their use, preservation, or exploitation.

The new zoning can be preemptive, applied to override previous zoning. Areas of Critical Community Value can also be regulated for their particular characteristics and importance, much as existing regulations control development in the flood plain. In other management approaches, the zoning can be made contingent upon the discretion and after the voluntary request of the property owner, or it can be an overlay zone, supplementing existing zoning.

The traditional rural village center, prime agricultural soils, and uplands associated with significant wildlife habitat, are three resources found in the Back Bay watershed which contribute significantly to the diverse environmental, historic, and cultural character of the City of Virginia Beach. Because of these values, such resources should be considered for designation as Areas of Critical Community Value and for special consideration in the Comprehensive Plan and Zoning Ordinance, within the Back Bay Management District.

#### **A Virginia Beach Land Bank**

Through a Virginia Beach Land Bank, the City could have land threatened by inappropriate development acquired in its behalf and later resold to appropriate users under suitable deed restrictions or covenants. If it merits consideration, the Land Bank concept should be given careful study by the City, especially with respect to evaluating its projected costs, revenues, and public benefits. While a Land Bank can be a most effective tool for bringing desirable land under municipal control without resorting to police powers, the costs of initiating the program could be high.

Until the revolving fund can be put on a self-sustaining basis through rev-

enue from initial land sales and user fees, the City might have to increase its bonded indebtedness, or resort to other means to provide funds for initial acquisition and development. In addition, for so long as land is held within the Bank, it would generate no property tax revenue, and a developer acquiring land from the Bank for a designated purpose could be forgiven the payment of taxes for a set period of time. User fees, including rental of land for productive farm use or other purpose, could provide revenue.

## Transfer of Development Rights

Transfer of Development Rights is a potentially suitable land use management tool for Virginia Beach. In the 1960's, town government in Vermont employed one variant of the concept, offering developers rights to develop town owned land in a non-sensitive section of the community in exchange for placing their original holdings in conservation status, in perpetuity. It is this type of transfer strategy—relating to sparsely settled land—to which the term “transfer of development rights” is commonly applied in the context of rural land protection. Similar development and land use controls are currently used by the Towns of Chilmark and Edgartown in Massachusetts and other municipalities, elsewhere. Both the Chilmark and Edgartown systems have consistently been upheld in judicial proceedings. To make transfer possible, the local governing body catalogs for each unit of land of a particular type—say farmland—the rights to develop a given number of housing units, ordinarily at the same densities as provided by current zoning.

These rights may be used to develop the property to which they are assigned, if approved under the Zoning Ordinance, or they may be sold by the property owner to someone wishing to apply them to a development in another area at a higher density than current zoning may allow. The City could impose regulations on the sale of development rights, although they could simply be traded on the open market. Development rights would be written into the deed for a property and, if not transferred, pass to successive owners by purchase or inheritance of the land. The

City could choose to specify that once they are transferred away from the parcel of origin, development rights would not be restored to the parcel, which would thus be protected in perpetuity. Development rights need not be assessed for the purpose of establishing property taxes, although they are frequently considered in determining the market value of land.

A Transfer of Development Rights system might work in Virginia Beach in the following manner: first, the City would catalog the right to develop housing as the number of dwelling units allowed by the Zoning Ordinance at the time of the adoption of TDR, on each parcel in the Back Bay Management District. An owner within the District could either build the entitled units on his or her land, given zoning approval, or sell the rights to an individual anticipating construction of a project on non-agriculturally zoned land. If the location of the developer's project were outside of the agricultural zone, or—more restrictively—outside the Back Bay Management District, the right to develop one unit, purchased from a Back Bay property owner, could be modified to become more than one additional unit of density at the project site.

“Overlay Zones” might be created across the entire city, with a transferred development right having a different value in each zone. This mechanism would encourage the accumulation of development rights for projects located in areas which the Comprehensive Plan has designated more suitable for denser development. The higher density would be expressed through the overlay zone which would give a ratio of greater than one to the transferred right. To prevent the accumulation of development rights for their resale value alone, a time limit could be established, within which the right would have to be applied to development, or else be forfeited.

A system for Transfer of Development Rights could benefit property owners in the Back Bay region, developers, and the general public, alike. TDR would give the City greater influence—but not necessarily strict control—over development in the Back Bay Management District, while helping to meet planning goals in other areas of Virginia Beach by

effectively channeling development to areas designated in the Comprehensive Plan for higher densities.

A workable system for Transfer of Development Rights would, however, require amendment of the City's planning and zoning authorities with enactment of new powers by the City Council. Under the Dillon Rule, a specific Charter amendment would have to be sought from the Commonwealth of Virginia's General Assembly, in order that Virginia Beach be invested with proper authority to enact a TDR system. However, there is no federal or state constitutional barrier to a TDR system in any county or municipality of the Commonwealth of Virginia.

## Protective Watershed Management Strategy Actions

- Adopt new zones for agricultural preservation and prime and productive soils, which would strongly restrict appropriation of agricultural lands for development.
- Create a larger lot residential zone of one dwelling unit per every three or four acres within the Back Bay Management District. Enlarge the lot size requirements in the R-1 zone.
- Change lot dimension requirements in the Ag-1 zone, as discussed above, and restrict the distance between private access points on public rights-of-way.
- Enforce the policy of “no new sewer service to Pungo Borough” as expressed through the Comprehensive Plan and the Capital Improvements Program, and seek assistance from the Commonwealth in strengthening health code restrictions on use of septic tanks for new individual homes.
- Provide no new public rights-of-way or road improvements for the watershed in the five year Capital Improvements Program geared to increased development potential.
- Increase the penalty that a developer pays through deferred property taxes for the conversion of agricultural land to a more intensive use.



- Develop a Virginia Beach "Land Bank" to acquire agricultural land and open space for public use and development.
- Develop and implement a "Transfer of Development Rights" program to encourage the achievement of city-wide planning goals. Transfer of Development Rights is an incentive system to make rural preservation more attractive in the Back Bay watershed, while increasing the economic desirability of development in designated areas throughout Virginia Beach.
- Adopt other measures defined under the Land Management Enhancement and Improved Land Management Strategies.

### **How the Protective Watershed Management Strategy Would Affect Back Bay and the City**

Most agricultural lands would be maintained in agricultural uses for the foreseeable future. Individual homes would continue to be built, but at low densities and with minimized impacts on agricultural production. Rural watershed character would be well protected. New economic uses of active farms and existing woodlots would emerge as the protected rural landscape of the watershed and protected wildlife habitat of Back Bay attracted overnight recreation and 3-season vacation travel.

Dissatisfaction on the part of some owners and developers may result from continuation and reinforcement of current zoning and development restrictions. But such dissatisfaction may be offset by new opportunities for owners and developers in the sale of development rights for utilization north of the Green Line and the new opportunities for the business community that such sales might make possible, if TDR is adopted. Additional economic opportunities would emerge through increased recreation/vacation activity in the watersheds.

Increased development activity, including in-fill development, would occur in other areas of the City, particularly in the Courthouse/Sandbridge Study Area. Some housing development activity could be lost to Chesapeake and Norfolk; on the other hand, the preserved attractiveness

of the Back Bay region would enhance the desirability of development areas on its immediate periphery within Virginia Beach.

**Evaluation.** This management strategy increases control over development in the Back Bay watershed and, at the same moment, gives the City more influence over general development patterns throughout Virginia Beach. It also requires additional municipal authority, including possible amendments to the City Charter, which must be sought from the Commonwealth General Assembly. The strategy is the most effective of the three approaches considered, in terms of protecting the Back Bay environment and providing for new vacation/recreation economic activity.

### **FLOOD PLAIN REGULATIONS**

Adequate protection of both the floodway and flood fringe areas is important both to preserving the character of the Back Bay watershed and to protecting the health and safety of watershed residents, present and future. The present 5 foot MSL 100 year flood plain contour should be maintained as the flood plain regulatory boundary but should be upgraded to a higher elevation if future flood studies indicate an increase in flood stage elevations.

### **WATER QUALITY AND SALINITY CONTROL**

The question of pollution is of overriding importance in the watershed. Agricultural run-off is not a significant problem at present and can be controlled through the adoption of improved crop irrigation and fertilization, livestock waste management, and ditch maintenance practices.

Urban run-off can also be carefully managed, with effective site and area sanitary controls and restrictions, effective storm run-off controls, litter and automotive waste entrapment, and other measures. However, experience in other regions has shown that the effects of urbanization of rural watersheds are difficult to control, in part due to the high per

capita cost of the utility installations needed for full environmental management during the early stages of urbanization. It is more than likely that, even with best efforts at environment management, adverse impacts on watershed and Back Bay water quality will result from urbanization of the Back Bay and North Landing River watersheds.

Given the finding of this report that continued maintenance of a brackish to slightly saline environment in Back Bay is desirable, the following pumping operational recommendations should be considered:

- Extend the pump line 6000 feet to a point northerly of Great Narrows, to enhance dispersion of the salt water output to the southerly sub-bay areas. Install three out-falls at Great Narrows and two intermediate points to promote dispersion.
- Adjust pumping operations to match salinity conditions in the Bay, increasing pumping rates following months of high precipitation and low salinity, and decreasing pumping rates following months of low precipitation and high salinity.

### **AGRICULTURAL PRACTICES**

Agricultural practices are well managed in the two watersheds, by and large. Additional attention to the following measures by area farmers, on a voluntary basis, would further improve environmental management in the Pungo Peninsula:

#### **Cropland Management**

- Adopt land and soil conservation measures and other "Best Management Practices" that minimize cropland erosion and loss of fertilizers and pesticides to surface waters. These measures include:
  - modified till (where better drained soils permit, the use of no-till should be encouraged).
  - ditch bank stabilization through proper angle of cut, slope compaction, and immediate planting with fescue, lespe-

deza, or other suitable conservation plants.

- careful maintenance of field tie-drains and lateral, lead, and main ditches; timely clearing of ditches and spreading of removed silt back on fields.
- installation of detention ponds, weirs, or other flow control devices on main ditches to reduce velocity, retard soil and nutrient runoff into Back Bay, and improve ground water management for increased crop yields.
- proper crop rotation, with double cropping of corn and winter wheat or other small grain the first year and no-till soy beans the second year. Winter cover crop should be planted on fields not devoted to small grain. With crop residues left on surface and either no-till or modified till employed, soil is protected from both.

### **Livestock Management**

- Site animal waste holding lagoons sufficiently distant from creeks, main ditches, wetlands, and periodically flooded lands to prevent inadvertent lagoon dike or dike seal failure.
- Dispose of waste on cropland or pastures at regular intervals, with spray irrigation equipment, if possible. Exercise care in spraying, to avoid overspraying into field ditches.
- Arrange cooperative purchasing or renting of spray irrigation equipment to afford small hog producers the means to spray irrigate animal wastes.
- Ensure that lagoon excavation spoil is not placed adjacent to ditches and creeks, is land spread or graded into shallow-sloped mounds, and is stabilized with conservation grasses.

### **CONTROL OF EROSION AND SEDIMENTATION.**

Basic measures for the minimization and control of erosion have been ad-

dressed under both the urban development and agriculture sections of this management chapter. Additional general measures should include the following:

- State and City regulations over silt run-off at highway, commercial, and other public and private construction sites should be strictly enforced.
- Filter strips of grass in a well-drained soil underlain by a sandy soil with some clay content should line the ditch edges of shopping center parking lots and similar large parking areas which are not drained by drainage structures. The strips should be sized in width proportionately to the drainage area served, with wider strips for the larger areas. They should be graded level or with a slight swale, or depression, to allow a slowing of run-off, absorption of some water, and a catching of debris. Both filter strips and ditches should be cleaned and maintained regularly.
- Detention basins should be installed at large shopping centers and other large commercial, industrial, and institutional parking lots to hold run-off and minimize the intensive surges that can occur at the start of storms on large paved surfaces.
- Pervious paving should be installed in shopping center and other large parking areas to increase rainfall infiltration and reduce runoff flows and intensities, where site engineering and soils studies find pervious paving suitable.
- All earth fill, including levelling mounds for building structures, foundations for road overpasses, lagoon dikes, culvert abutments, and other fill applications, should be planted with stabilizing vegetation immediately. Mesh fabric and mulching should be applied as necessary to hold soil and young plants in place.

### **RECREATIONAL IMPACT MANAGEMENT.**

Outdoor recreational activity, including beach access, wildlife observa-

tion, fishing, and hunting, are generally compatible with Back Bay environmental quality. Outdoor recreationists in the Bay and its watershed lands are largely sympathetic to the environment and aware of the need to avoid adverse impact on the Bay's environment. Unavoidable or inadvertent impacts, however, can result from several sets of circumstances in one or another activity type. And some recreationists, unfortunately, abuse the very environment which serves their interest.

### **Beach and False Cape State Park Access**

Beach access takes place primarily through the Atlantic margin of False Cape, outside the Bay watershed. Access by boat to landings on the Bay shore of FCSP is possible, and some recreationists take advantage of this route. Little Island Park and Sandbridge are heavily visited in summer.

The Back Bay National Wildlife Refuge, which occupies 4.3 miles of Atlantic beach line, is also visited by beach-goers who walk in. Access to this stretch of beach and to False Cape State Park to the south of the NWR is denied to vehicles by the U.S. Fish and Wildlife Service, with certain limited exceptions, in order to protect the nesting grounds of the Atlantic loggerhead turtle and the feeding and nesting habitats of peregrines, the brown pelican, and the bald eagle, all Endangered Species. Proposals have been considered to modify the federal-state ownership lines, basically to swap land to permit open vehicular access to False Cape State Park, but to date this issue remains unresolved.

Attention should be given to the potential impact of future access plans since any significant change in vehicular traffic could affect watershed-edge habitat and wildlife and, indirectly, Bay water quality.

### **Recreational Boating**

Although boating has not been specifically a subject of this study, management overview of this activity should be conducted in the future. Boating activity levels and peak usage are bound to increase over time, and boating related problems could be avoided if prior thought is paid to them.



Power-boats, particularly those employing high-horsepower, high-decibel engines, have emerged as a concern among some Bay recreationists. Loud engines and high boat speed will discourage many wildlife species, as well as dishearten other recreationists. One possible approach which merits further exploration is to zone the Bay, allowing high horsepower and/or high speeds only in zones with sufficiently large water surfaces away from habitat resources.



### Key to Map 13: Bay and Watershed Management

The map illustrates key strategies and directions of the Management Plan for Back Bay. Because the map cannot portray all of the actions and measures recommended by this report, the reader should review Chapter 6 in its entirety for the Plan's full scope and options.

All of the Back Bay watershed and the portion of the North Landing River watershed adjacent to it (area within the gray zone to the east of the river on the Pungo peninsula) would constitute a **Back Bay Management District**. Creation of the district will permit implementation of Comprehensive Plan policies consistently throughout all areas potentially affecting Back Bay's environmental quality.

The **Green Line**—boundary between the more restrictive Back Bay related lands and the less restrictive lands of the northern portions of the Courthouse-Sandbridge Planning Area—is relocated northwards to the limits of the Back Bay watershed and, in effect, becomes the boundary of the Back Bay Management District. A less extensive relocation to selected points to protect key drainage and habitat related areas could also improve Bay resource protection.

Village centers, key points of public access to the Bay, uplands and flood plain associated with significant wildlife habitat, and other lands adjoining significant aesthetic and environmental resources would be protected as **Areas of Critical Community Value**, because of their significant contributions to the environmental, historic, and cultural character of Virginia Beach.

**Prime agricultural soils** would be protected under an amended zoning ordinance. The new city-wide zoning district could also include forests and primitive lands. A city-wide inventory of lands possessing "demonstrable community value" would be compiled based on suitable survey criteria to identify eligible lands.

**Flood plain lands** become more effectively conserved for agriculture, recreation, and wildlife habitat protection within the District.

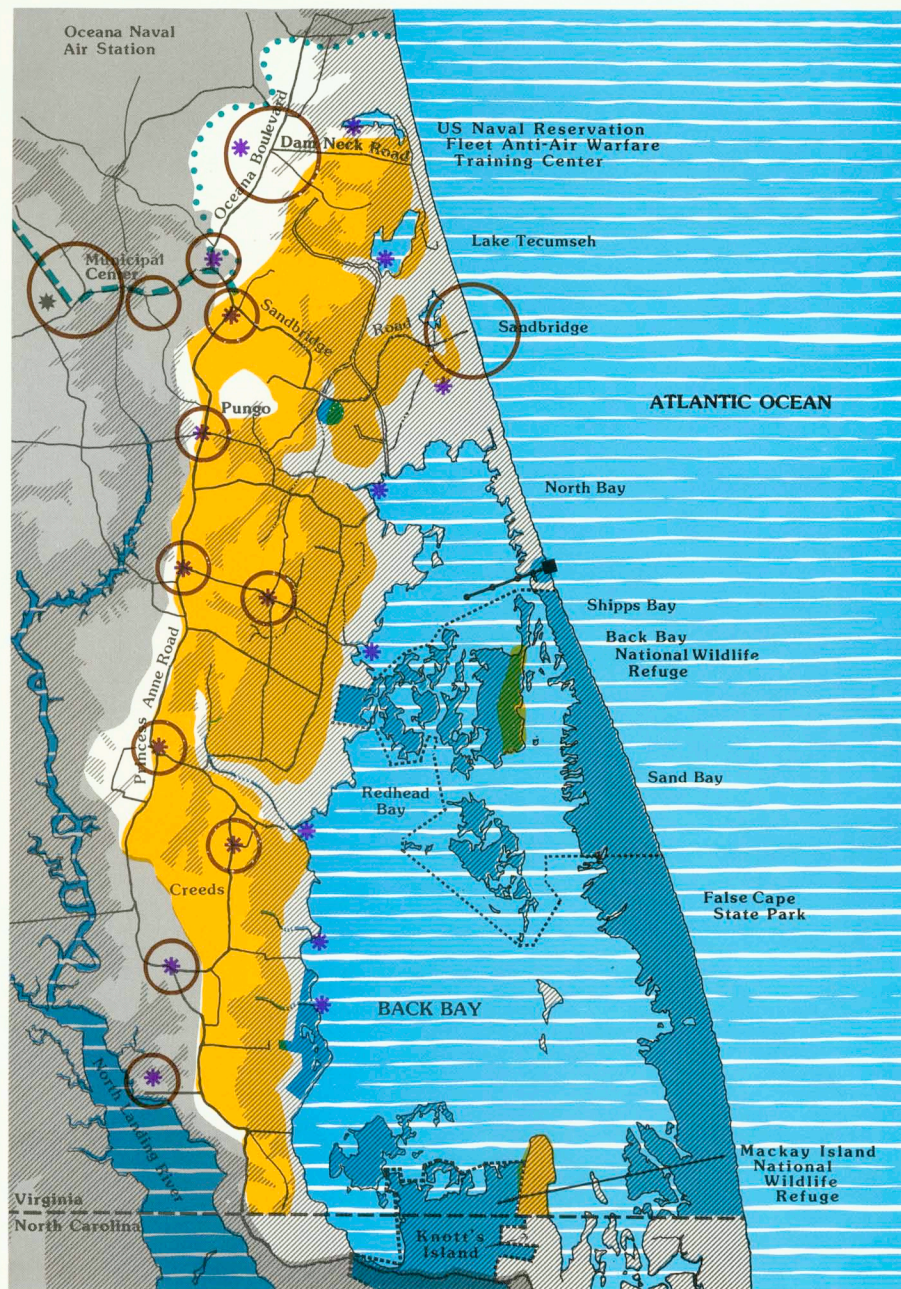
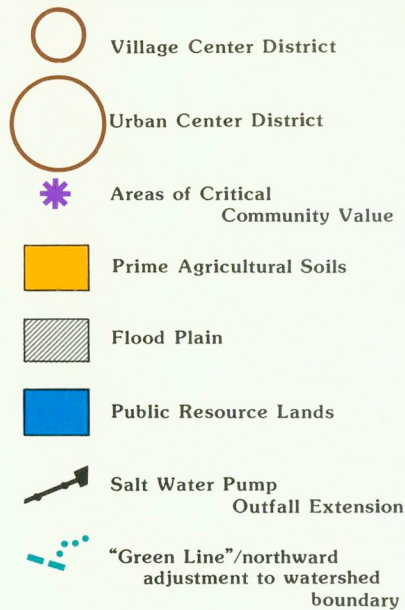
Measures are taken throughout the District to enhance **wildlife protection** and improve **recreation/vacation resource potential**.

**Public resource lands**, particularly the national wildlife refuges and the state waterfowl management areas, continue to serve as the habitat backbone of Back Bay, while False Cape State Park continues to serve as the recreational highlight of the region.

In Shipp's Bay, an extension of the Little Island salt water pump line is shown. The new construction will improve dispersion of introduced sea water. Operational adjustments from month to month will augment pumping when average Bay salinity is low and curtail it when salinity is high.



Map 13  
**Bay and  
 Watershed Management**







## BIBLIOGRAPHY

- Bracken, Thomas B. "Sturges v. Town of Chilmark and Chilmark Planning Board. Brief for Defendants-Appellants." Gateman and Slade, Inc., Boston, Massachusetts, 1979.
- Clark, John. "Status of Estuarine Ecosystems in Relation to Sportfish Resources." The Conservation Foundation, Washington, D.C. March, 1975.
- Clawson, Marion. *Suburban Land Conversion in the United States: An Economic and Governmental Process*. The Johns Hopkins University Press, Baltimore, Maryland. 1971.
- Eighmey, Kathleen M. *The Beach: A History of Virginia Beach, Virginia*. Virginia Beach Department of Public Libraries, Virginia Beach, Virginia. 1976.
- Extension Division, Virginia Polytechnic Institute and State University. "Best Management Practices for Row Crop Agriculture." June, 1980.
- \_\_\_\_\_. "Best Management Practices for Swine Operations." November, 1980.
- Omernik, James M. "The Influence of Land Use on Stream Nutrient Levels." U.S. Environmental Protection Agency, Environmental Research Laboratory, Corvallis, Oregon. January, 1976.
- Reilly, William K. *The Use of Land: A Citizens' Guide to Urban Growth*. Thomas Y. Crowell Company, New York, New York. 1973.
- Rogers, Peter and Steinitz, Carl. *A Study of Resource Use in Urbanizing Watersheds*. Office, Chief of Engineers, Department of the Army, Washington, D.C. June, 1970.
- Scott, R.W., et al, editors. *Management and Control of Growth* (three volumes). Urban Land Institute, Washington, D.C. 1975.
- Southeastern Virginia Planning District Commission. *Virginia Beach Waterfront Access Study*. June, 1981.
- U.S. Council on Environmental Quality. *The Costs of Sprawl*. United States Government Printing Office, Washington, D.C. April, 1974.
- U.S. Department of Agriculture, Soil Conservation Service. *Drainage of Agricultural Land*. Water Information Center, Port Washington, New York. 1973.
- U.S. Fish and Wildlife Service, Region V. *Draft Environmental Impact Statement: Proposed State-Federal Land Exchange Involving Portions of False Cape State Park and Back Bay National Wildlife Refuge*. Newton Corner, Massachusetts. 1982.
- \_\_\_\_\_. *Final Environmental Impact Statement: Proposed National Wildlife Refuge on the Currituck Outer Banks*. Newton Corner, Massachusetts. 1980.
- Virginia Beach, City of. *Comprehensive Plan*. Virginia Beach Planning Department, Virginia Beach, Virginia.
- \_\_\_\_\_. *Statistical Development Information Package*. Virginia Beach, Virginia. May, 1983.
- \_\_\_\_\_. *A Study of Housing in Virginia Beach*. Virginia Beach Planning Department, Virginia Beach, Virginia. April, 1983.
- \_\_\_\_\_. *Zoning Regulations, Subdivision Regulations, Site Plan Ordinance*. Virginia Beach, 1983.



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